OCTOBER, 1929

Railway Engineering and Maintenance

Waste Money On Useless Fillers?

APPLY HY-CROME and forget your costly experience with those spring washers that loose all of their reactive power in a few months of service.

Your section forces will never find any occasion to use more than one HY-CROME per track bolt. Its great reactive range compensates for all wear and insures tight rail joints regardless of the traffic conditions.

Why put up with frequent failures? Your rail joints do not need new spring washers every year.

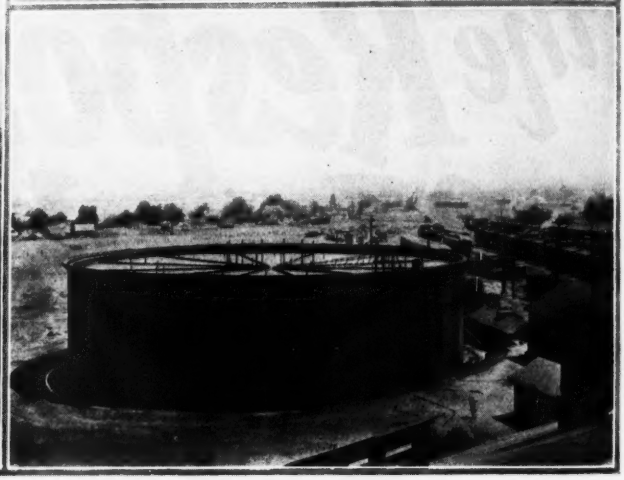
HY-CROME protection is permanent.

The Reliance Manufacturing Company
Massillon, Ohio
Address Dept. M. E.

HY-CROME

"The Most of the Best for the Least"

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 76 Classified Index to Advertisers, 72-74



Left: Two panel conical-bottom tank with 150,000-gallon capacity on Northern Pacific at Glendive, Montana.

Above: Two creosoting plant tanks at Blair, Ore.
Below: Wiggins Floating Roof on a railway fuel oil tank.

STEEL Tanks for Railway Water Service — Horton tanks are constructed entirely of steel. They render dependable service at low cost. Long life decreases annual investment cost. Replacements of parts are few and painting is practically the only maintenance. Cleaning is done periodically without taking the tank out of service by opening a washout valve in the bottom of the riser.

STEEL Tanks for Creosoting Plants—Standard elevated and storage tanks are adapted to creosoting plant and other uses where liquids are handled and stored. Special piping connections and other openings are installed as required.

STEEL Tanks for Fuel Oil Storage—Flat-bottom steel tanks are used to store quantities of fuel oil at central locations and elevated tanks deliver it to locomotives. The storage tanks may be equipped with Wiggins Floating Roofs to protect them from fire. This device rides on the oil, eliminating the vapor space in the tank and making it impossible for the oil to ignite.

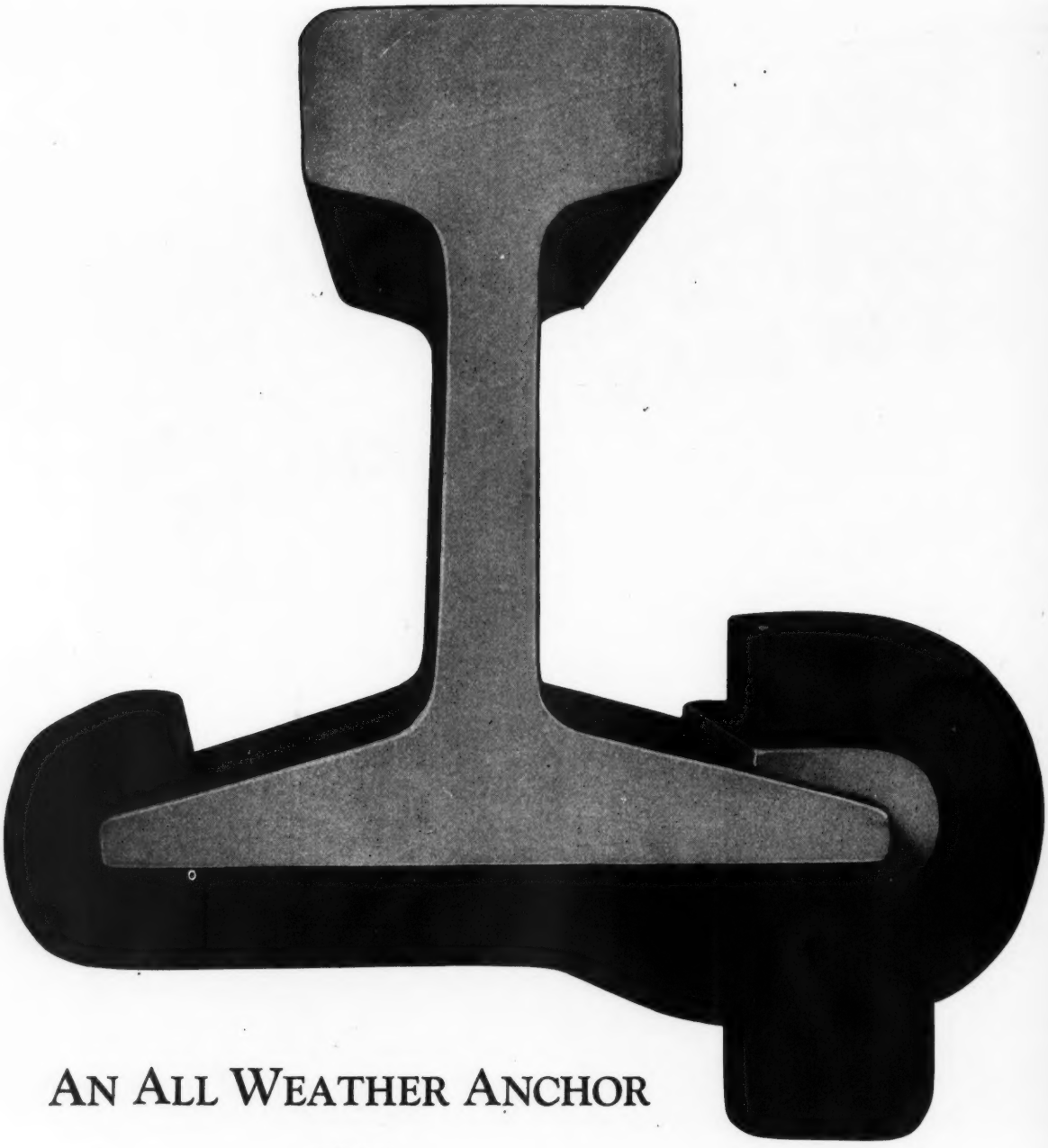
Ask our nearest office for information or prices on steel tanks of any kind. They are completely erected with our own experienced field erection crews. Get estimates now on contemplated installations.

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Boston	1522 Consolidated Gas Bldg.	Havana	Apartado 2507

B-102

HORTON TANKS



AN ALL WEATHER ANCHOR

THE ERICSON RAIL ANCHOR

Works just as efficiently in winter as in summer. Years of service in Northern United States and Canada have proven its worth in extreme climatic changes.

APPLY ERICSONS NOW — JUDGE RESULTS THIS WINTER

VERONA TOOL WORKS PITTSBURGH

EXPENSE *of digging up broken drain* . . . it's a thing of the past

RAILWAY service is a real test for subdrains. Loads are tremendous —their damaging effect is multiplied by impact and vibration. And drainage breakdowns must be repaired at once—often at a greater cost than the original installation.

Because Armco Perforated Iron Pipe is flexible, it cannot break. This pipe has been proved by many years' use under the most heavily traveled trunk lines. It is immune to vibration, impact and frost. And it cannot disjoin. The pipe comes in long sections which are joined together by coupling devices, to form a continuous drain of any desired length.

An interesting bulletin, "Increasing Efficiency of Roadbed Drainage," tells about the application of Armco Perforated Pipe to the drainage of railway cuts, tunnels and switchyards; for landslide-prevention, and many similar installations where continuous drainage is essential. Write for a copy.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

ARMCO *perforated* PIPE

Use flexible pipe—it cannot break

WORLD-WIDE WELCOME FOR KALAMAZOOS

WHEN the big ships get into port, there's always somebody waiting for "Kalamazoos," so world-wide is the dependence of the railways upon the unique service given by Kalamazoo Motor Cars.

They earn their welcome by their performance.

The Kalamazoo 25-A is a heavy duty car for extra gang and hump yard service. With standard body as shown, it seats 12 men and hauls trailers loaded with men or track materials. Is furnished also with special body for hump yard service, which seats 24 men.

Full information on request.

Motor Car
No. 25-A

"Kalamazoo Means Service to You"

KALAMAZOO RAILWAY SUPPLY COMPANY

MANUFACTURERS—Established 1883

KALAMAZOO, MICHIGAN

KREOLITE

Aerial View of Part of the Toledo Plant of The Jennison-Wright Company

Framing of Timbers "BEFORE" Treatment Is Essential

By the installation of the latest and most modern framing and boring machinery, we assure the purchaser of timbers most accurately framed at lowest cost.

The life of treated timber depends upon the character of the preservative used. *We distill our own Creosote oil.* By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

Enormous stocks of Railroad Cross and Switch Ties, Structural Timbers and Piling, in all sizes, of Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, at Granite City, Ill. (East St. Louis).

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES

Troubles never come singly

"T never rains but it pours"—and it's a perversity of fate that if there be any weaknesses in a motor car they are apt to show up just when you need that car most.

Low price limits quality—limits the greatest contributing factor to low maintenance, dependable service and long life.

There are no restrictions on Sheffields. The quality that is built into them tells its own story in service rendered. Their *first* cost *must* be a trifle more, but those few dollars on the purchase price have saved railroads thousands in maintenance and even more by dependable service in emergencies.

FAIRBANKS-MORSE

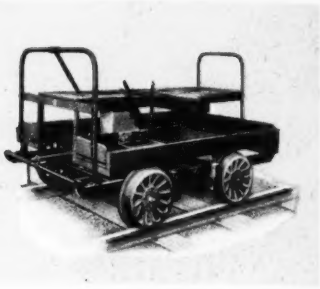
TIMKEN BEARING EQUIPPED

First on the rails—and still first

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

"Figure Sheffield" Quality in savings dividends



Sheffield quality is an investment that brings dividends. The proof is a matter of record. Railroads that have kept a careful check have found that Sheffield quality is a definite feature that can be figured in lower maintenance.

Appreciation of these savings dividends has been generously expressed in orders. The past few years have seen the greatest increase in Sheffield sales in Sheffield history.

The Sheffields that inspired such confidence were good cars. But the Sheffield organization never rests on its laurels. They have developed many new refinements that make Sheffields the outstanding value in Railroad Motor Cars today.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; Diesel engines—stationary and marine; electric motors and generators; steam, power and centrifugal pumps; scales and complete coaling stations.

FAIRBANKS-MORSE

MOTOR CARS

TIMKEN BEARING EQUIPPED

RA21.60

REDUCE CURVE DRAG
and wear on rails and flanges

WHEN trains round a curve, the flanges crowd and tend to climb the rail thereby increasing the curve drag and wear on rails. It is right on these curves that

MEXICAN GRAPHITE CURVE GREASE

furnishes effective lubrication which cuts down the frictional resistance between the rails and flanges.

As a result, Mexican Graphite Curve Grease reduces the high cost of track maintenance on divisions of heavy curvature by increasing the life of rails and reducing expensive track disturbances due to renewals of track sections.

Mexican Graphite Curve Grease sticks and stays on tires and rails—regardless of rain, sleet or snow and affords protection against friction long after ordinary grease has outlived its usefulness.

A trial will convince you.

The United States Graphite Co.
Saginaw, Mich.

Philadelphia New York Chicago Pittsburgh San Francisco St. Louis

Safer Bonds

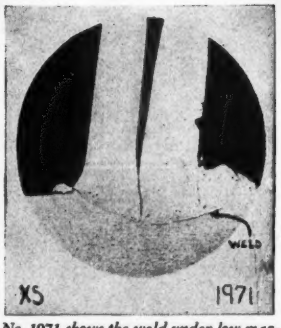
American Signal Bonds

The Type DS-1 Bond is made with the usual steel pin and two conductors, each conductor composed of one central copper wire surrounded by six galvanized steel wires.

A TEST

In order to disprove that the wires in our American Stranded Signal Bonds are adversely affected by the welding heat, we had this examination made. The extreme heat localization which is effected by our process is clearly illustrated in the following micro-photographs. Photograph No. 1971 shows the weld under low magnification. Photograph No. 1956 shows the structure of the steel adjacent to the weld along the wires. Photograph No. 1965 shows the normal structure of the wires which is found at .2 cm. from the weld. It is very interesting to note that the grain structure of the wires is refined immediately adjacent to the welds, instead of coarsened, as would be the case if the wires were overheated. This refinement is obtained by performing work upon the wire while hot. Consequently, we obtain a refinement of the metal adjacent to the welds and maintain the normal structure to within .2 cm. from the welds.

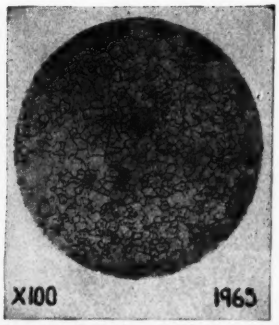
The Type S-1 Bond is made with the usual steel terminal and one conductor composed of one central copper wire surrounded by six galvanized steel wires.



No. 1971 shows the weld under low magnification.

No. 1956 shows the structure of the steel adjacent to the weld along the wires.

The American Steel & Wire Company has a rail bond for every requirement. Our engineers will be glad to assist you in selecting the best bond for your needs.



No. 1965 shows the normal structure of the wires which is found at .2 cm. from the weld.

American Steel & Wire Company

Subsidiary of United States Steel Corporation

208 S. La Salle Street, Chicago 30 Church Street, New York

Under Sales Offices: Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City Minneapolis-St. Paul Oklahoma City Birmingham Atlanta Memphis Dallas Denver Salt Lake City U. S. Steel Products Company: San Francisco, Los Angeles, Portland, Seattle *Export Distributors:* United States Steel Products Co., 30 Church St., New York

Fairmont Big Discer Demonstrates Timken Dependability

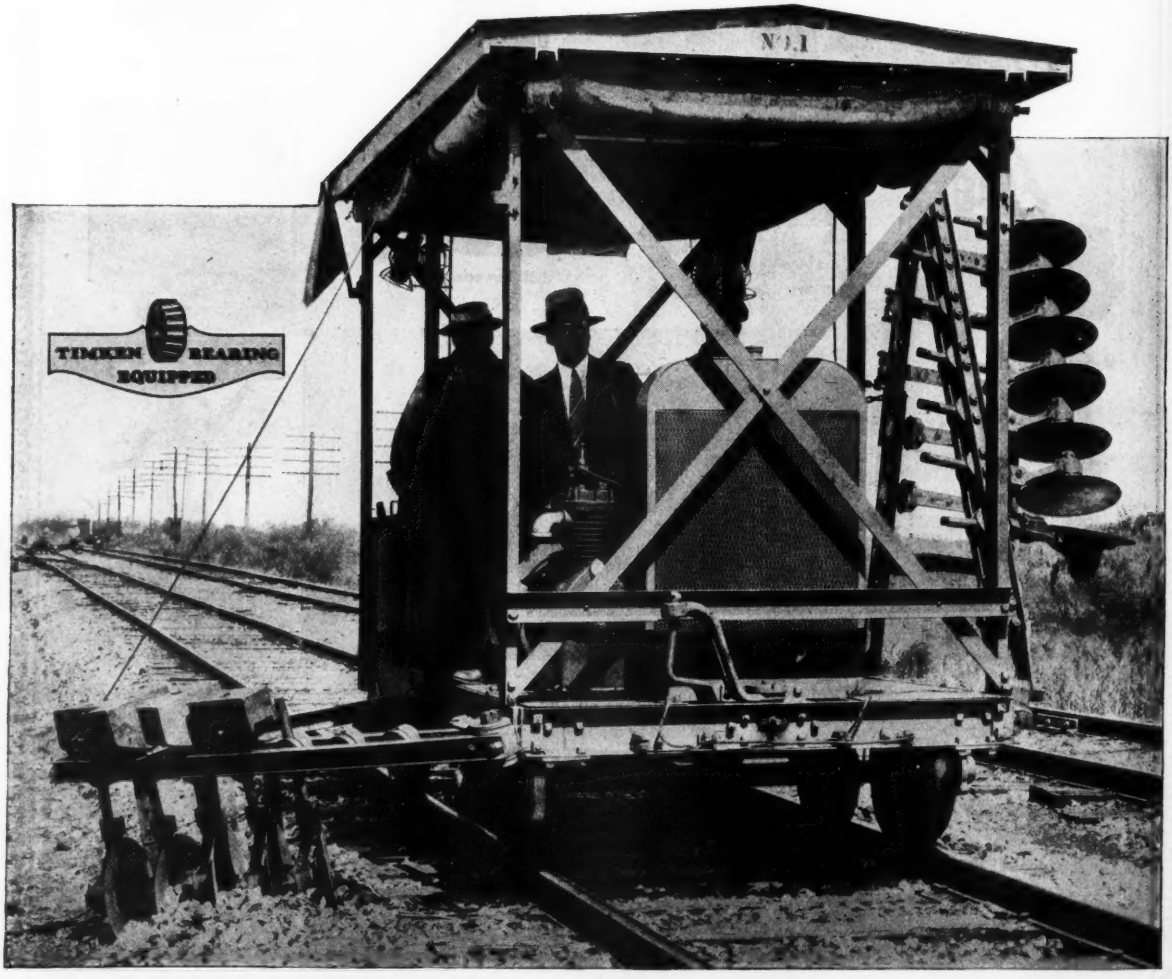
Every maintenance-of-way man knows the severity of the conditions under which these discers operate, especially when discing ballast as illustrated below.

Fairmont Railway Motors, Inc., Fairmont, Minn., know this too—they have protected their machines with Timken Bearings at all hard service points—for Timken is *one bearing that does all things well,* whether the loads are all *radial,* all *thrust or a combination of both.*

There are 39 Timkens in the Fairmont M23 Big Discer—2 in each of the 16 discs, 5 in the Brown-Lipe 4-speed transmission and two on the compressor crankshaft.

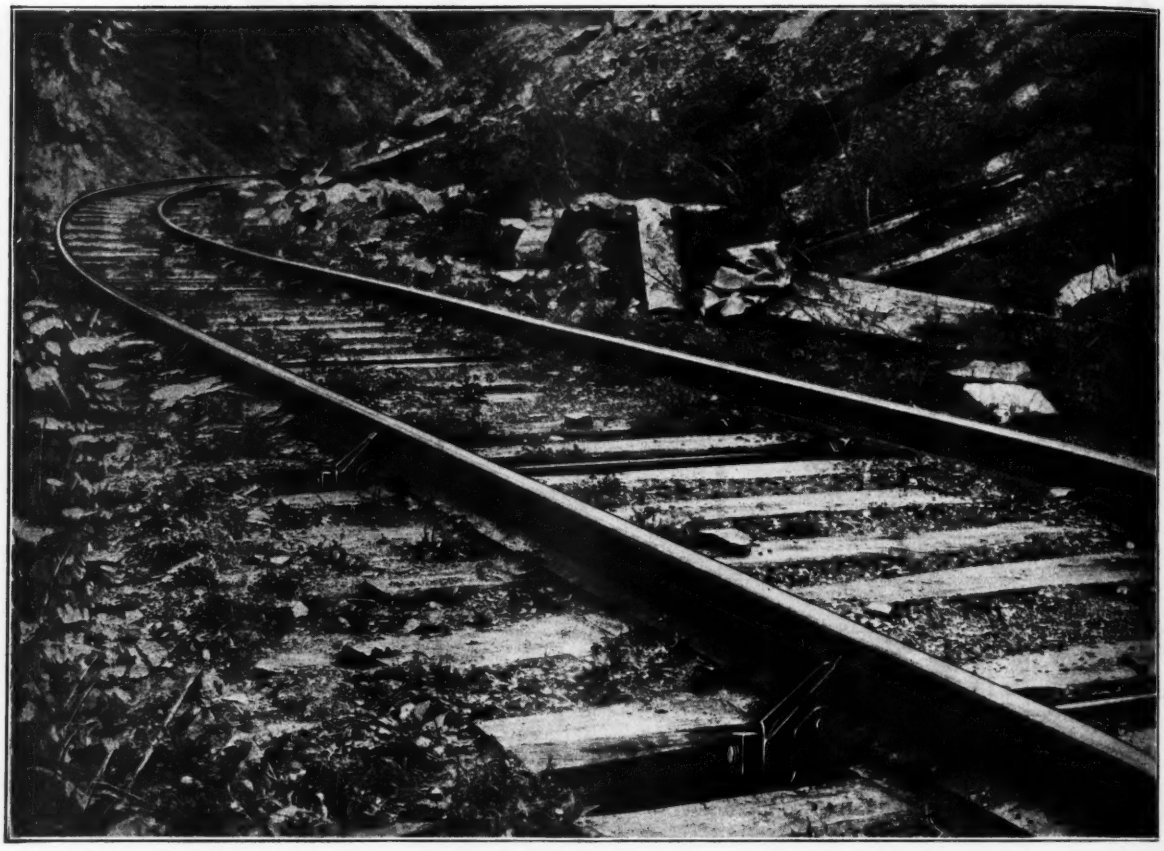
In these positions the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken steel not only adds strength and endurance to the discer, but by reducing wear and frictional power loss to the vanishing point, it cuts upkeep costs to the bone.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



TIMKEN *Tapered Roller* **BEARINGS**

PERFECT—TRACK



"We are not only happy over the results obtained on this track, but especially over the maintenance savings which we have made."

So destructive were the wheel shocks on above curve, that this track formerly required the constant attention of two men.

These wheel shocks now absorbed by the Coover Shock Absorbers are made constructive, because they force each part of the device to tighten its grip on rails . . . thereby, the shock is also exhausted.

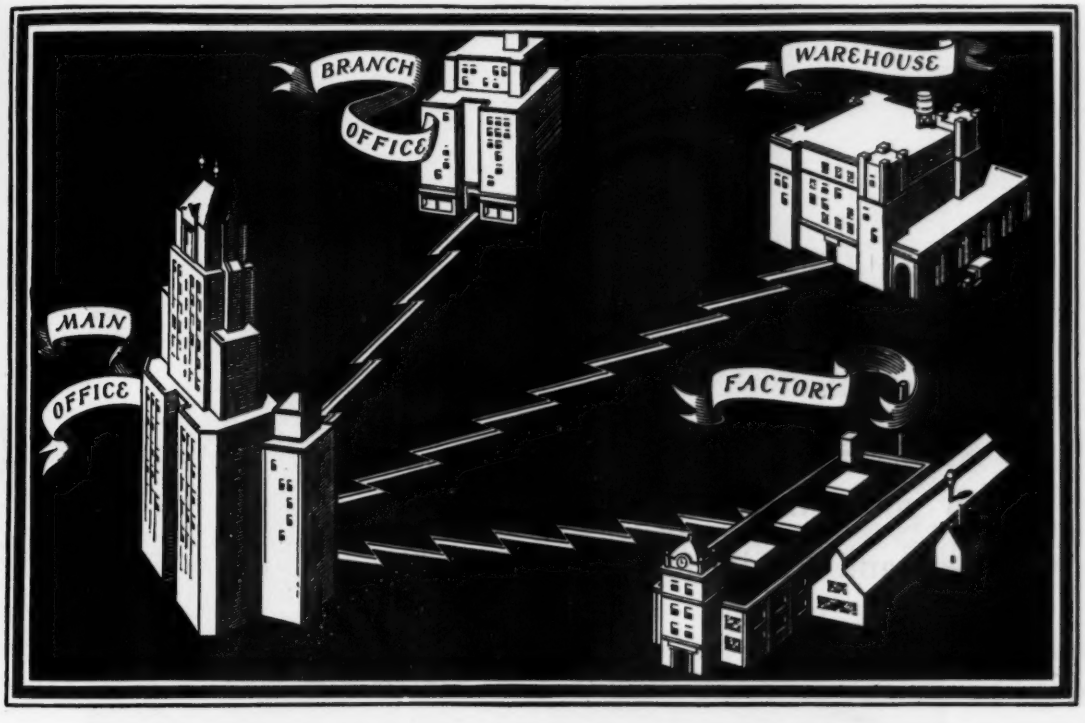
Our Shock Absorbers have been in use on above track for over a year. We have quoted above, from the Superintendent's letter, and he further writes that no regauging of track has been necessary since they were applied.

Neither has there been any respiking or re-tieing and he writes that to all appearances the ballast has remained undisturbed.

THE COOVER RAILROAD TRACK BRACE CO.

DAYTON, OHIO

2 or 22 connected offices receive the message Simultaneously



SPECIAL arms of the telephone service are being called into use more and more by business concerns. These Bell System private wire services have been developed to fit the varying needs of business.

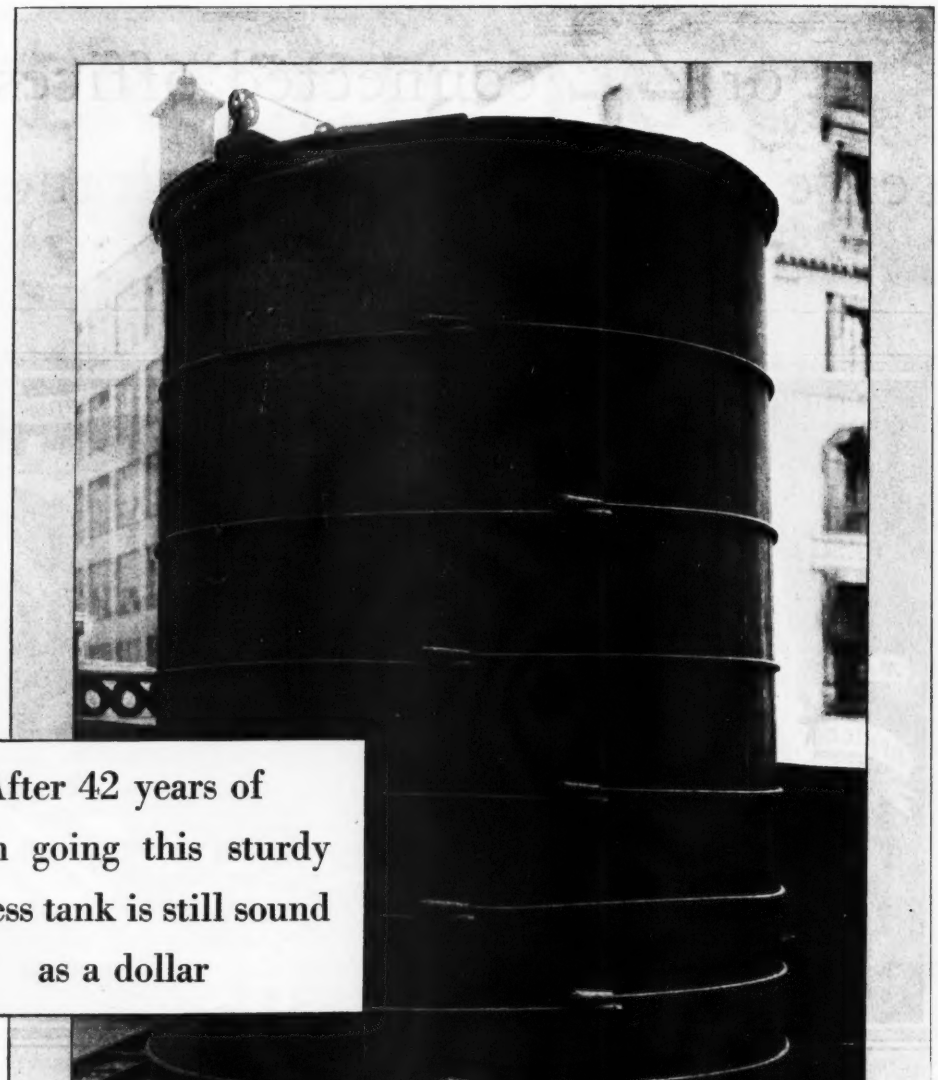
Telephone Typewriter Service, one of these special arms, is a quick, accurate method of inter-office communication.

It connects main office with branch houses, factories and warehouses for instant typewritten communication. It is just like having all of your units under one roof. As large a number of points as desired can be reached at the same time on the same circuit.

Telephone Typewriter Service is being used increasingly by electric light and power companies, manufacturing firms, newspapers, press associations, investment security houses, brokerage and bond concerns, banks and government departments.

Would this special arm of the telephone service bring development and profit to your business? It can be tailor-made to suit your special needs.

Your local Bell Telephone Business Office will gladly discuss it with you. Bell Special Services are *Convenient . . . Economical . . . Universal.*



After 42 years of tough going this sturdy cypress tank is still sound as a dollar

PERCHED on top of the Bodmann Building in Cincinnati, this Hauser-Stander Tidewater Red Cypress tank has rebuffed moisture inside and out for almost half a century.

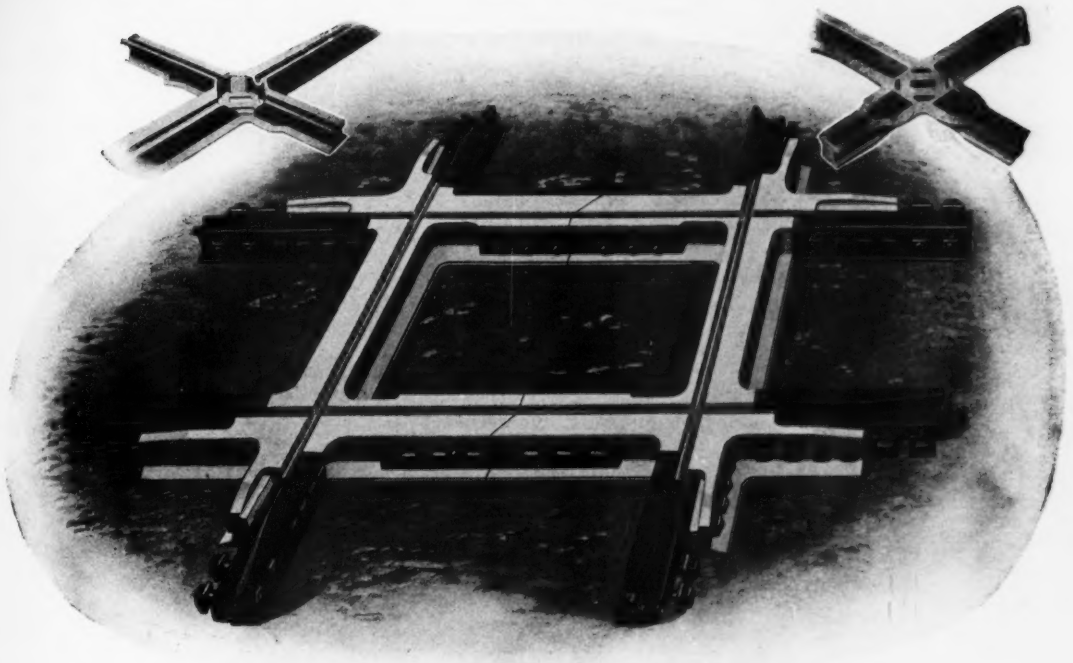
In hundreds of railroads throughout the country, this same durable lumber is cutting down operating expenses on every mile of line.

More and more every year, railroad men employ Tidewater Red Cypress for passenger station construction, freight sheds, warehouses, ties, platforms, signal conduits, water tanks, box cars, fencing, and, in short, any use where long life and freedom from repairs are essential.

Technical data will be supplied gladly by the Southern Cypress Manufacturers' Association, Jacksonville, Florida.

TIDEWATER RED CYPRESS

THE WOOD ETERNAL



Dependable Crossings for Heavy Service

The NEW Scientifically Designed CROSSING Fulfills Expectations

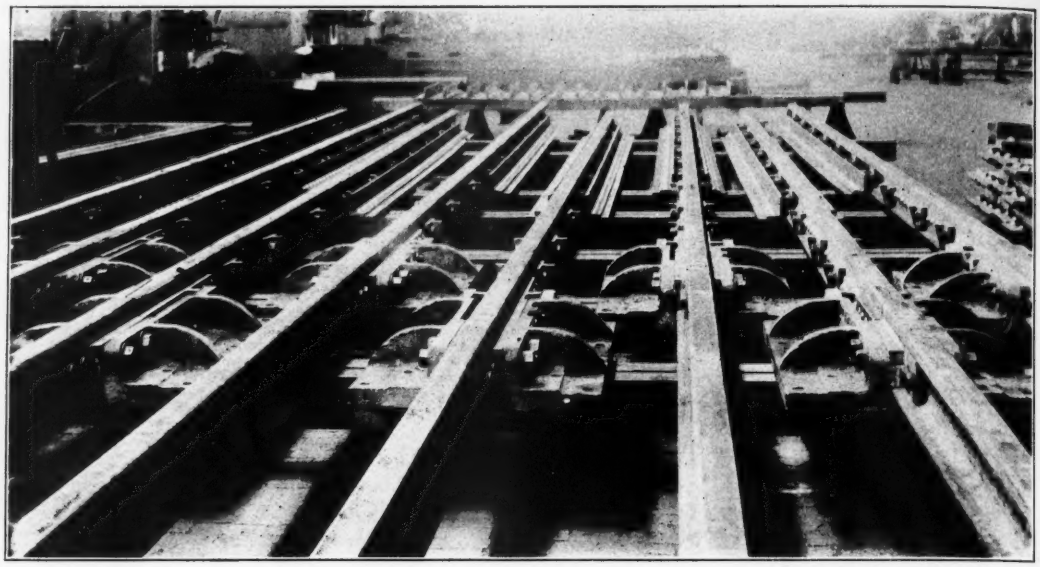
WITH freight trains of over a hundred cars and heavy locomotives running at passenger train speeds as they are today on many of the roads, means that the design of crossing and quality of the manganese steel is of vital importance.

Why not get the latest and best solid manganese steel crossing made—The Wharton Scientifically Designed Type—the crossing that has so far been installed in the tracks of over fifty of the leading Steam and Electric Railway Companies.

William Wharton, Jr. & Co., *Incorporated*

Easton, Pennsylvania

SALES OFFICES: San Francisco Chicago El Paso Boston Pittsburgh Scranton



One of many sets of bridge rails furnished a leading Eastern Road - - - -

THE Wharton Plant is exceptionally well equipped for taking care of work of the special character illustrated, and such specialties constitute an important part of the regular output.

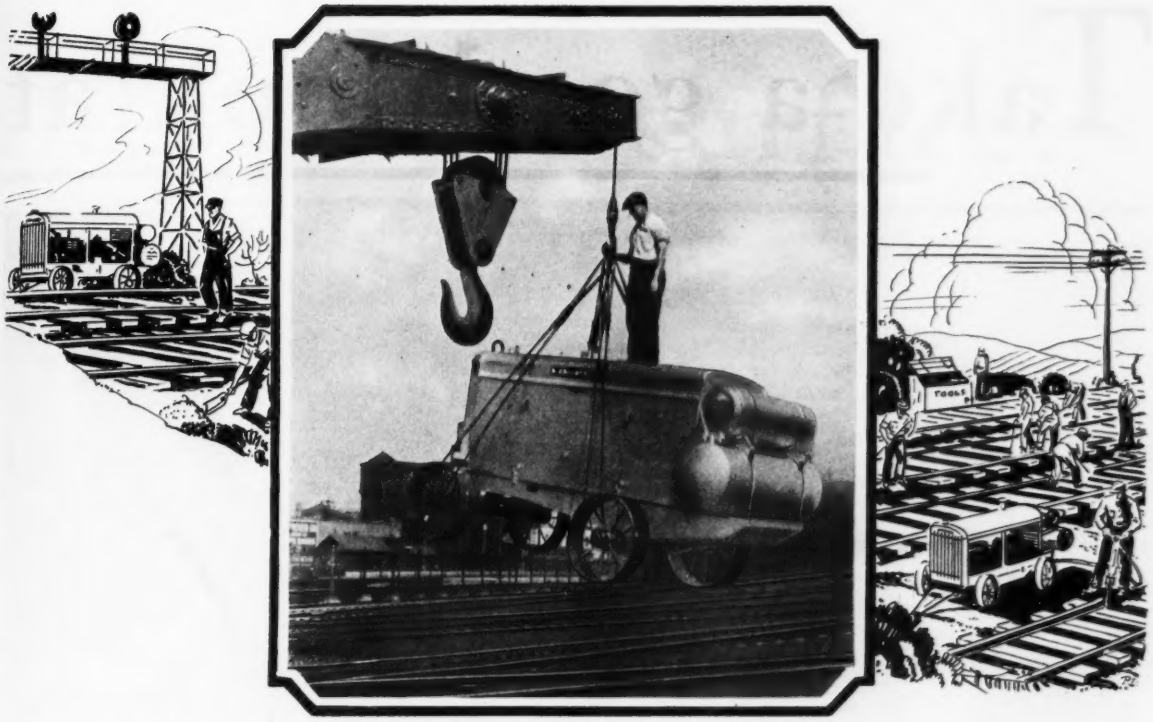
GUARD RAIL CLAMPS

INSULATED AND NON-INSULATED GAUGE RODS

WHARTON - O'BRIEN INSULATED AND ADJUSTABLE PULL AND LOCK RODS

William Wharton, Jr. & Co., *Incorporated*

Easton, Pennsylvania



Helping the Reading Railroad to Electrify

The Reading Railroad is using 330 cu. ft. "AIR KINGS," for the operation of demolition tools in placing tower foundations for their new electrification program. "AIR KING" PORTABLE COMPRESSORS enable the Reading to save the cost of from 5 to 50 men for each machine employed.

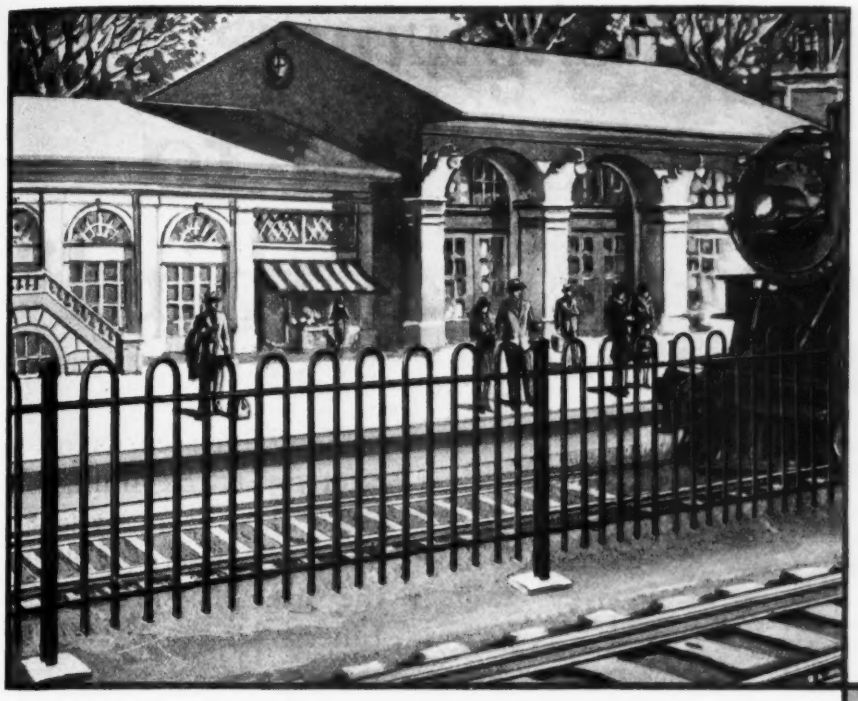
Five of the major railroads in this country, as well as a large number of outstanding public utilities and contractors, are now using M-W "AIR KINGS" for "Profitable Portable Air Power."

METALWELD, INC., 26th & Hunting Park Ave., PHILADELPHIA, PA.

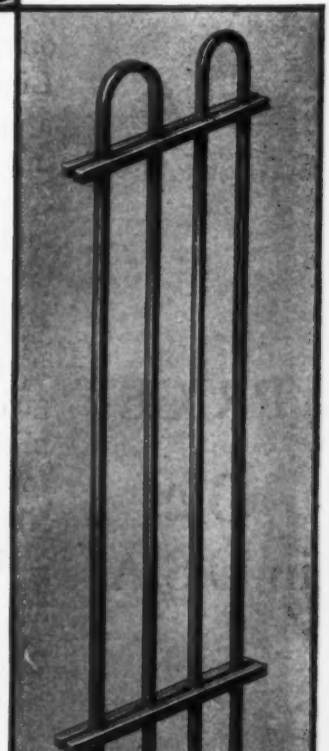
Dealers in Principal Cities

METALWELD-WORTHINGTON

PORTABLE AIR COMPRESSORS



The Strength is in the Weld . . .



Welded strength insures long, maintenance-free life . . .

for this Anchor-Weld Intertrack Fence

THE panels cannot buckle or sag; the pickets cannot loosen. Permanent alinement and rigidity is guaranteed by the Anchor-Weld method of manufacturing iron intertrack fence.

Pickets and rails become a solid panel—each picket inseparably welded to the rails at 32 points. Not only does this welded construction provide exceptional strength, but it also results in a fence of attractive appearance, since unsightly braces and other reenforcements are not required.

A 'phone call to the nearest Anchor office will bring a detailed description of Anchor-Weld Intertrack Fence.

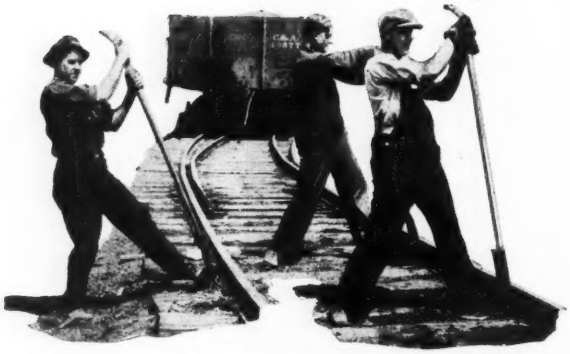
ANCHOR POST FENCE COMPANY
Eastern Avenue and Kane Street, Baltimore, Md.

Albany; Boston; Charlotte; Chicago; Cincinnati; Cleveland; Detroit; Hartford; Houston; Los Angeles; Mineola, L. I.; Newark; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Shreveport

Representatives in all principal cities. Consult local classified directory.

ANCHOR Fences

"--a splendid showing; lining costs cut to a third"



Three men with Bloxhams replacing 9 to 11 in track lining.

Many fine records in cutting track lining costs have been made by roadmasters with the use of Bloxham Liners.

Time studies taken on competitive tests have shown that 3 men with Bloxham Liners will do the work of 9 to 11 men with bars and in approximately half the time possible with any other lining device. Letters received from officials of prominent roads also testify to the remarkable saving in time and labor by this tool. The man on the job likes the Bloxham because it is operated with a *pull*—the natural way—which gives relief to tired muscles.

PRICE 6.50 in U.S.A.

Bloxham Liners are made of electric steel and are guaranteed against breakage in service. They are supplied with a long base for gravel ballast or a short base for rock ballast. Direct sale to the railroads makes possible the low price—$6.50 f.o.b. Chicago. Send orders and inquiries to

CHICAGO STEEL FOUNDRY COMPANY

Makers of alloy steel for twenty years

Kedzie Avenue at 37th Street, Chicago, Illinois

BLOXHAM Track Liners

Fully covered by U. S. and foreign patents.

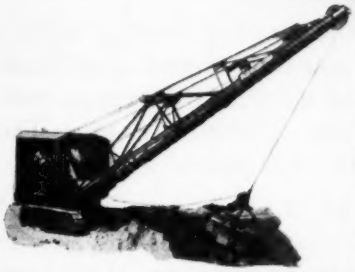
We will exhibit Bloxham Track Liners and Knuckles in Booth 45, Stevens Hotel.

REM 10-Gray

One of these HALF-YARD CONVERTIBLES per division . . . .

As a ½-yd. Shovel.

Equipped with Magnet.



As a dragline.

As a crane it handles a bucket, magnet, sling or hook with equal facility.

On practically any division of any railroad there is always enough work to keep one of these half-yard convertibles busy constantly. Ordinary excavating, grading, loading, material handling, leveling, trenching and a host of other jobs, all come within the easy range of these P & H Excavators.

Compact, husky, built to stand the racket as an all-round, hard-knocks machine, this P & H is convertible into crane, dragline, shovel, or pile driver. It is always available, always reliable. It will ride on a standard flat car without dismantling, after climbing aboard under its own power. A 50 h.p. gasoline motor insures all the power ever necessary to this excavator of half-yard capacity. The line speed of 150 feet per minute and a revolving speed of 5½ r.p.m. give it speed far beyond that of larger machines. It is a worker, a producer, a time and money saver, and it is a fine investment for any railroad's maintenance of way department.

Bulletin GH-3 describes the remarkably versatile and useful unit in detail.

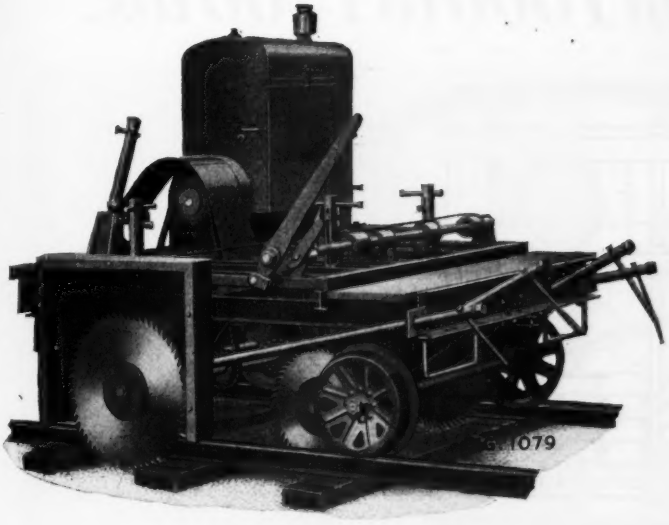
HARNISCHFEGER CORPORATION
Established in 1884
3820 National Avenue, Milwaukee, Wis.
WAREHOUSES AND SERVICE STATIONS:
Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas

P&H EXCAVATORS

Prolong the Life of Ties and Reduce the Cost of Laying Rail—

with the

NEAFIE TIE SCORING MACHINE



IN relaying rail, the Neafie Tie Scoring Machine makes certain that the new rail receives a uniform bearing on the ties. Normally ties are adzed by guess, with the result that the surface upon which the tie plate rests, may cant either inward or outward. Usually the greatest depth of the cut is immediately under the rail, thereby throwing most of the tie bearing at the ends of the tie plate with the result that the plate cuts into the wood fibre.

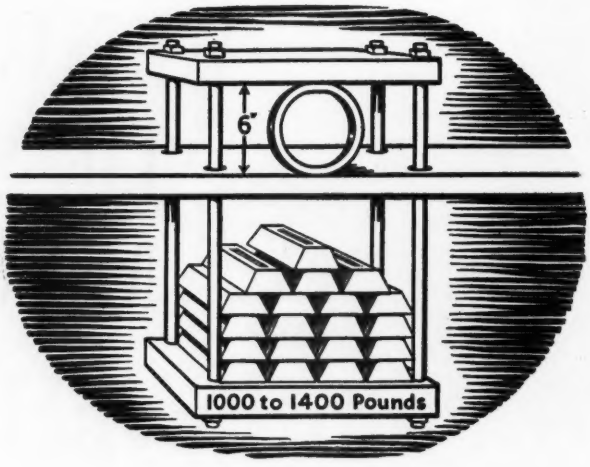
The Neafie Tie Scoring Machine eliminates this tie destroying condition. All the ties are scored to proper depth in four places which furnishes an accurate guide for the adzing and assuring a full even bearing for the tie plates. Not only is the correct amount of adzing secured as regards each tie, but it can be done in a horizontal plane or at any angle of inclination.

This machine has demonstrated through long use that it reduces the cost of rail laying and that it is a big factor in prolonging the life of ties.

It is self-contained and built to be moved along the existing rails making a cut at right angles to the plane of the rail heads, 9 3/16" outside of each gauge line and 6 13/16" inside of each gauge line. These dimensions will be increased by the kerf of the saw in both cases. The maximum saw, 26" diameter is used to make the outside cuts and 19½" in diameter for inside cuts.

Both saws will clear the top of the rail by 2 inches when the car is traveling along the right of way. Each saw is independently adjustable for depth of cut by sixteenths of an inch and is locked at each setting. All four saws are raised to traveling position by one hand wheel, a ratchet and wheel holding them in place. The saws are guarded, thereby protecting workmen against injury.

A deLavaud pipe section one inch wide will support *a load of from 1000 to 1400 lbs.*



THE remarkable ability of deLavaud Pipe to withstand severe crushing strains was demonstrated in a ring-crushing test. This test was conducted by a recognized authority, whose report reads in part as follows:

"Six rings, two each cut from the bell end, the middle, and spigot end of a length of deLavaud pipe picked at random from the manufacturer's stocks, constituted the test samples. These were cut from the pipe band on a lathe and were one inch wide. These rings were quite elastic and the metal appeared to be of a good smooth even grain. Results showed that the load required to cause failure was from 1000 to 1400 lbs."

The facts about deLavaud's great strength are accepted in engineering circles everywhere. It has been definitely proved that deLavaud has 25% greater resistance to internal pressure than good pit cast pipe. The above tests demonstrated deLavaud's ability to withstand tremendous *external* crushing strains.

Those who would know the secret of deLavaud's greater strength need look no further than the microstructure of the metal itself. It is even, close grained and free from slag and blow holes. It is made by pouring molten iron into a rapidly revolving cylindrical mould. Centrifugal force holds the metal against the mould, and drives impurities out *with a force 40 times greater than gravity.*

Cast iron pipe made by this Company bears the "Q-check" trademark of The Cast Iron Pipe Research Association.

Let us send you the deLavaud handbook and complete facts and figures about deLavaud Pipe.

United States Pipe and Foundry Co., Burlington, New Jersey

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Subject: ADVERTISEMENTS

Dear Reader: September 10, 1929
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Last month I wrote you about the part that the advertiser plays in making it possible for you to receive Railway Engineering and Maintenance for the nominal subscription price that you now pay for it. This month I want to direct your attention to these advertising pages.

The manufacturers place their advertisements in our publication in order that they may bring to your attention the equipment and the materials which they make and which they believe will be of use to you. Obviously their expenditure is justified in direct proportion to the extent to which you read their "copy." They are, therefore, keenly desirous of preparing their copy in the manner in which it will interest and serve you best.

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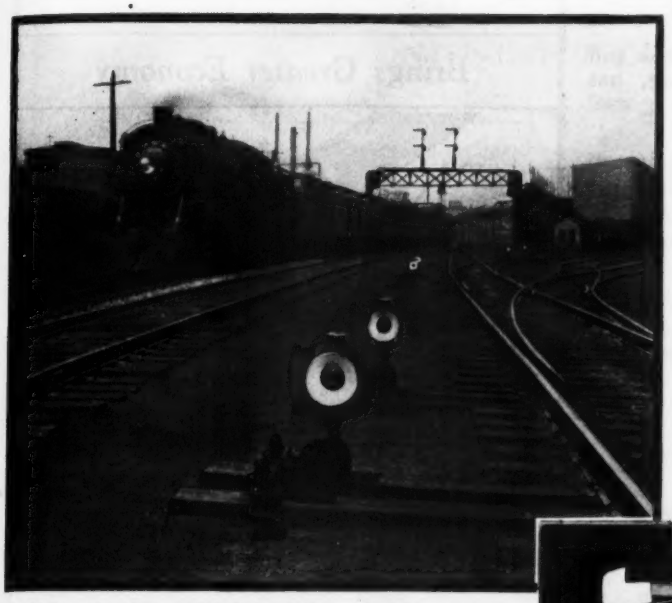

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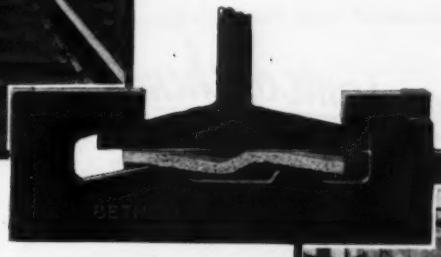

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Volume 25 October, 1929 No. 10

Water Station Progress

THE railways are making progress, but it is only through retrospect that one can fully realize how great this progress has been. Picture, for example, the typical water station of a quarter century ago. It consisted of a frame shed, usually near a stream crossing, set low enough so that coal dumped from the track could be handled conveniently to the fire box of the locomotive-type boiler which supplied steam to a duplex horizontal steam pump. In some cases, of course, such a plant had been replaced by one in which piston or plunger pumps were belt-driven by an electric motor or, more often, by a one-cylinder gasoline engine, the intermittent coughing of which will hardly have been forgotten by anyone who ever heard it even if he never operated one.

But whatever the exact details of the plant, one thing is certain—nearly all of them required constant attendance during the periods of the day that they were in operation. There was little about these old plants to suggest a layout of the kind described on page 416 of this issue, in which the pumps in three wells are brought into service automatically, one after another, as the demand for water increases and in which each pump is installed in a separate pit carefully constructed to insure the maximum protection for the equipment it houses.

These modern plants cost more than the pumping stations of old. Their construction has required the scrapping of much old equipment and there is no denying that the more efficient facilities of today have become possible only as the railways have enjoyed greater prosperity. However, full credit must be given to those officers who have been sufficiently enterprising to study the possibilities of better facilities and have demonstrated to their managements how money could be saved by spending money. There are still many water stations in service today that have outlived their usefulness and which point to opportunities for the installation of new equipment which will pay for itself in a short time even if the existing plant does not need to be replaced because of inadequate capacity.

Taxes

In 1916 the Class I railways of the United States spent $250,545,000 for fuel. In the same year they spent $119,785,000 for taxes. In 1920 the expenditures for fuel were $675,000,000 and for taxes $272,000,000, while in 1928 they were $354,200,000 for fuel and $389,432,000 for taxes. In other words, the increases in fuel costs and in taxes during the war period were fairly comparable, but since that time the railways have made a most enviable record in reducing fuel costs, while the cost of government has continued to mount until it now takes 6.4 cents of every dollar received by the roads.

Furthermore, in 1928 for the first time the railways' tax bill exceeded that for fuel and this tendency is even more pronounced this year. In other words, for every shovel of coal that is now being thrown into the fire box, the equivalent of another and larger shovelful goes for taxes. The tax bill of the railways now amounts to more than $1,000,000 a day or $42,000 an hour.

Three Outstanding Associations

THE engineering and maintenance of way branch of the railways is served by three associations with outstanding records of service to the industry. The American Railway Engineering Association, the youngest of the three although itself nearly 30 years old, is the most influential by reason of its larger membership and the fact that it includes within this membership those who formulate the policies on engineering and maintenance operations. Even more important, however, is the thorough-going manner in which its members go about the study of the problems in hand.

Second in age among these three associations is the American Railway Bridge and Building Association, which has a record of 38 years of constructive service to that branch of engineering activity involved in the construction and maintenance of bridges, buildings and water stations. Its proceedings constitute a most valuable library of modern practice in the solution of the problems within its field, while its current reports contain much valuable information that is not found elsewhere. Indicative of the practical character of the topics which it is considering are the following which will be reported on by committees at the convention at New Orleans next month: Wearing surfaces for passenger and freight platforms; the inspection and maintenance of track scales; the selection and training of foremen; the protection of underground pipe lines; and the elimination of accidents to men working off the ground.

The third and oldest of these organizations is the Roadmasters' and Maintenance of Way Association, which is nearing the half century mark, the convention reported on following pages being its forty-seventh. The intensely practical character of its work is revealed by reports and papers which were presented this year. Such topics as the control of weeds, permanent track forces, the proper way to lay rail, the selection and training of track foremen, the maintenance of roadway work equipment and the control of tie renewals, are very real to these men and the correct answer to many of the problems suggested by these

topics is a matter of vital concern to them.

The railways are greatly indebted to all three of these organizations for the contributions which they have made and are now making to the development of efficient railway practices. Their work is so closely related and yet so distinct that there is a definite field for each organization. For this reason, all three of them deserve the hearty support of the roads in order that they may continue to do their best work.

Welding in Steel Bridge Work

THE adaptation of electric welding to structural steelwork is a relatively recent development and while a number of steel frame buildings and a few minor bridges have been fabricated and erected with the use of this process the practice is still viewed with an attitude of definite conservatism by the bridge engineers. They have, however, been much more receptive to this process as applied to the repairing or reinforcing of old bridges where it has demonstrated especial adaptability and definite economy as compared with the long-accepted process of riveting. Bridge engineers are watching this work with a lively interest, and the behavior of the bridges on which the welding process has been employed will exert a profound influence on its greater application to bridges, particularly to the construction of new bridges.

Turnouts with Relay Rail

WHEN new rail is laid on important traffic lines, a considerable amount of second-hand turnout material is released. The disposition of these partly worn switches, frogs, lead rails, stock rails and their fittings is a matter of considerable economic importance, since the use of new materials in the turnouts, when the relay rail is installed in secondary or branch lines, results in a direct out-of-pocket cost which can be avoided if the released turnout material can be used.

In general, the decision depends in large measure on the condition of the second-hand turnout material. If it is in good condition and little worn, there is no reason why it cannot be used with the rail with which it has already served, provided proper precautions are taken to mark the rails for relaying in the same order that they occupied originally. If this is done and care is used in the installation, the riding qualities of the track should be satisfactory and the subsequent maintenance little if any greater than if new material had been used.

If the turnouts are considerably worn, however, the situation is different. No matter how carefully the matching is done, a smooth surface or good line is seldom secured, and the maintenance cost is likely to be out of proportion to the saving that is accomplished by using the second-hand material. Furthermore, when the renewal of these old frogs or switches becomes necessary, the ends of the adjacent rails are probably more battered and worn than they would otherwise be. If this occurs, the new frog or switch even if made of relay rail, must be matched against the badly worn rails, or these rails must be replaced with less worn material, which also adds to the later cost of maintenance. It may be possible, of course, to build up these rail ends to increase their life and provide a better fit, but even if this is done, the cost of doing so must be considered, particularly if it is an isolated job of welding.

Where the wear is great enough to make the use of this material in the main tracks undesirable, but not enough to warrant scrapping it, it can frequently be used to advantage in secondary turnouts or in switches that are not used as frequently. In this way the potential life of the released material can be developed, equally economical use of the material secured and better main track conditions obtained.

The question of using second-hand material is of sufficient importance from the standpoints of economy, track conditions and maintenance to warrant a thorough study of each case by those maintenance officers who are responsible for making the decision. In any event the matter should be settled only after a thorough inspection of the material itself and a knowledge of the conditions under which it is to serve during the second stage of its use. In making such an inspection, particular attention should be given to the condition of the stock rails, since a new switch should never be applied to a worn stock rail, as chipping and breakage of the switch point may occur after the passage of a few trains, with consequent danger of derailment.

Surface Blemishes on Concrete

SURFACE blemishes on concrete have for years been the concern of the engineer, for they have not only defaced many otherwise attractive structures, but have presented difficult and expensive problems of repair. Unfortunately, the greatest trouble with surface blemishes is experienced on the vertical faces of concrete units which are more frequently exposed to view than the horizontal surfaces.

Many an engineer experienced in concrete work has been surprised and keenly disappointed to see the surfaces of carefully designed and constructed concrete structures disintegrate after a few years of exposure, and has usually attributed the failure to the deteriorating effect of gases in the atmosphere or to the destructive action brought about by the alternate freezing and thawing of the moisture in the concrete near the surface. No doubt, these agencies had a part in the failure of the concrete, but in recent years it has come to be realized that by far the greatest factor in such failures of concrete is not in the concrete itself as poured, or in the effect of external agencies, but rather, in improper curing.

In an article appearing on page 412 it is given as the opinion of the concrete engineer of the Delaware, Lackawanna & Western, that 75 per cent of the failures of concrete in vertical surfaces, that are not occasioned by structural weakness, are due to inadequate curing during hot weather. In this article it is pointed out that the engineer who insists upon careful curing during cold weather, and who, likewise, insists upon securing adequately cured concrete in horizontal members by wetting down periodically, almost invariably fails to take the necessary precautions to cure adequately concrete poured in vertical or inclined members. Thus, while horizontal surfaces are protected and kept moist for about 28 days in most instances to insure proper curing, vertical surfaces, possibly because of the somewhat greater difficulty of covering them and wetting them down, are allowed to stand exposed to the rapid drying action of the wind and the sun.

In the same article the concrete engineer of the Lackawanna also questions the practice of spading near the forms, a commonly accepted practice in securing a good appearing surface on the concrete,

and says, in effect, that much of the spalling off of the surface of concrete is due to excessive spading and floating work, which brings to the surface the richer mortar with a co-efficient of expansion quite different from that of the concrete in the main body of the unit. This, it is pointed out, permits unequal strains in the concrete during expansion and contraction, and often results in the cracking away of the surface concrete.

With the increasing importance of securing a lasting surface on concrete as this material becomes still more widely used in units and structures where appearance is an important factor, there will be, no doubt, many engineers and supervising officers in the field who will wish to give careful consideration to these points.

Surprise Tests

THE SURPRISE test is not new in railway service. It has long been accepted as a necessary check on the observance of rules among train-service employees on many roads. Its inauguration was resented at first by many of the employees as an unwarranted attempt to "get something on them," but as the men found that the purpose was solely to insure compliance with the rules they came to appreciate that it constitutes a protection to them as well as to the traveling public, from the careless or chance-taking individual within their ranks. The surprise test has, however, been confined largely to the transportation department.

In a report on Means of Detecting and Correcting Unsafe Methods in Track Work, which was presented before the Roadmasters Association and is published on a following page, the committee recommends that maintenance supervisory officers institute similar surprise tests to insure that those employees under their direction follow at all times the rules drafted for their protection. It would not be surprising if some maintenance officers should resent this suggestion on the ground that it would tend to make "spotters" of them. Yet it is in reality a logical part of their work for their duties embrace not only the organization of their forces and their instruction in proper and safe methods of doing their work, but the taking of such measures as may be necessary to insure that these instructions are followed in all respects.

Maintenance of way work is steadily becoming more complicated. Not only are the requirements of traffic growing more exacting but the materials employed are heavier and more difficult to handle. Likewise much of the equipment furnished the men can itself create hazards if improperly employed. These changing conditions require the constant revision of rules to eliminate new hazards as they develop. Yet the formation of rules is not in itself sufficient. Nearly every accident to maintenance employees results from the violation of some rule and would not have occurred if the rule had been observed in its entirety. Obviously it is an essential part of the responsibility of every maintenance supervisory officer, therefore, to enforce compliance with the rules and to satisfy himself that they are being obeyed in his absence as well as when he is present.

The violation of rules does not usually result from ignorance or lack of familiarity with the rules, for the periodic examinations that are conducted on most roads eliminate this possibility. Rather they are deliberate—it is for the purpose of effecting some short cut that men take a chance. It is through this cause that most accidents occur and it is only after they occur that any lapse in practices is brought to light. The surprise test affords a means of detecting those lapses before they lead to an accident.

One of the outstanding achievements of the railways during recent years has been the reduction of accidents among their employees. This progress has been much greater on some roads than on others. The road with which the chairman of this committee is connected has made a particularly noteworthy record in this respect. The suggestion offered in this report is drawn from his experience and warrants careful consideration particularly because of this fact.

Conventions

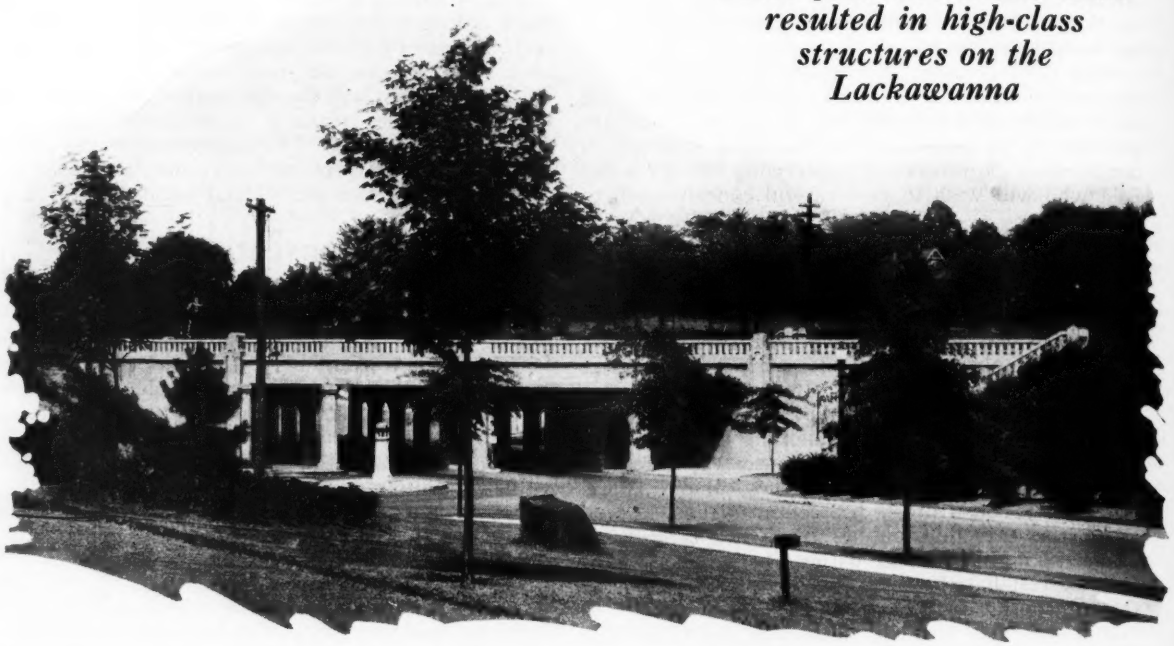
AT THIS season of the year when so many division engineers and supervisors of track, of bridges and buildings and of water service are thinking so largely of the conventions of their respective associations and of the discussions of problems of direct concern to them that will take place there, it is not amiss to call the attention of these men to the equally valuable results that would accrue to their foremen if they were offered similar opportunities to compare experiences regarding their problems. It is in appreciation of this fact that a number of maintenance officers follow the practice of bringing the foremen together on their various divisions to discuss their work. With a similar purpose, other roads take their foremen over their respective divisions in a group to give them an opportunity to see the work of their fellow foremen, to compare notes on their practices and to discuss the results of these practices as evidenced by the track before them.

Regardless of the character of the meeting, such gatherings have just as great educational value for alert foremen as the conventions do for supervisory officers. The railways can do much to increase the efficiency of their maintenance foremen by affording them a greater opportunity to "talk shop" and compare ideas regarding their common problems. As maintenance work is becoming more intricate and as the demands upon maintenance foremen are becoming more severe, the need for the education of foremen is growing and the benefit of such meetings is increasing.

High Viaduct on the Chicago, Milwaukee, St. Paul & Pacific in the Bitter Root Mountains

How to Avoid Poor

Some practices which have resulted in high-class structures on the Lackawanna



The Pleasing and Substantial Concrete Structure on the Lackawanna over Madison Avenue, Madison, N. J.

FOR MANY years the Delaware, Lackawanna & Western has given a great deal of concerted study to the design and installation of concrete structures, and it has achieved such marked success in its concrete work that this type of construction is now given precedence wherever possible. As a result of its extended study and experience, this road has learned much about concrete construction and repair, and it is today building structures which should stand up indefinitely without signs of failure.

While proper methods of repairing concrete are considered of importance on the Lackawanna, much more stress is laid on the importance of securing concrete which will stand up under any conditions presented without the necessity of maintenance and repair, which is one of the chief advantages sought in concrete construction. In the first place, the railway employs a specialist in concrete design and construction whose obligation it is to secure strong, pleasing and permanent concrete structures; and in the second place, it accepts the theory that money spent in securing high-grade concrete is repaid many times in the appearance of the finished structures and in the lack of necessity for costly repair work.

Body Cracks Can Be Prevented

The deterioration of concrete units or structures usually appears in one of two distinct forms; body cracks and surface disintegration. The first of these classes of failures can be attributed usually to poor foundations, poor concrete, poor workmanship, inadequate design, or a combination of these causes. With all of these causes given due consideration during construction, there is little likelihood of such cracks appearing. On the Lackawanna, foundations are given the most careful consideration as to their bearing area and the bases of all concrete units are placed at least four feet below the ground level to preclude the heaving action of frost. All concrete is prepared to rigid specifications under the eye of trained inspectors to see that it is properly proportioned, mixed, placed and cured. In addition, concrete is sampled from every pour for test purposes during construction.

Mixing and pouring operations are given special attention to insure the thorough mixing, rodding and tamping of the concrete, and despite the seeming delay which might occur in some instances, no haste is permitted in removing forms, particularly during hot weather when no other type of protection is provided to insure proper curing. Adequate and well-spaced expansion joints are also employed extensively in concrete units on the Lackawanna to minimize body cracks, and, not infrequently, where such cracks are anticipated and where expansion joints are undesirable, extra heavy, or addition reinforcement is used. In certain instances old rails have been used effectively as tie rods in concrete units, precluding the development of cracks. Abrupt changes in section in a unit are usually points of weakness and, therefore, the Lackawanna makes it a practice to provide additional reinforcement at these points. Likewise, it is usually the practice on the Lackawanna to construct deep V-shaped lines in a structure at points where cracks are anticipated, so as to induce straight and less offensive cracks in the event that cracks occur.

Body Cracks Can Usually Be Repaired

The repair of body cracks in concrete may or may not assume large proportions. If, on careful examination, it is found that a crack is more or less superficial,

in that it discloses no unsound concrete and is not such as to impair the strength or stability of the unit, the crack can be repaired quite readily if desired. On the other hand if the cleavage penetrates well through the interior of the mass, sufficient to render a section of the unit definitely unstable, and, particularly, if it penetrates any quantity of poor concrete it may be advisable or necessary to rebuild the entire unit, or that part of it affected, because of the inability to make effective repairs.

Ordinarily the only attempt made on the Lackawanna to repair superficial body cracks is to hide their unsightly appearance. If the crack is vertical and more or less straight, this is done by cutting a true V-shaped valley up through the line of the crack to give the appearance of an expansion joint. In the case of an irregular crack, it is recognized that there is little else to do but widen it out at the face of the structure, clean away all loose material, and then plaster it shut as deeply as possible with a rich concrete mortar. A wood float can be used in this work, but it is felt that it is preferable to place the mortar under pressure with a cement gun.

Sometimes cracks are so located in units such as bridge piers, abutments and retaining walls as to make it advisable to cut away a large part of the unit and to rebuild it to its original lines. In doing this, the main thing sought is a good bond between the new and old concrete. Such a bond can be secured by carefully cleaning away any loose or disintegrated concrete from the exposed surfaces; wetting down the old surface thoroughly with water, or, preferably, with a thin cement grout; and then applying the new concrete, which incidentally, should be of the same mix as the old concrete so as to preclude rupture of the bond caused by unequal temperature stresses set up in two dissimlar masses of concrete with different coefficients of expansion. In most cases of this nature it is recommended that the normal bond between the surfaces of the new and old concrete be supplemented by the use of heavy steel dowels, grouted deeply into the old concrete and encased in the new. The Lackawanna has used short lengths of old rails successfully for this purpose where heavy dowels were required.

How to Prevent Surface Blemishes

Surface blemishes on concrete units are usually more common than serious body cracks, but if they occur on units constructed recently by the Lackawanna, it is felt that it will be in spite of every practical effort to remove their causes. The main agency causing the disintegration of sound concrete is fairly well known to be water, either pure and exerting a solvent and erosive action, or bearing in solution chemical reagents which act upon the concrete along lines peculiar to their several characters. Therefore, one of the most important precautions to be taken against the disintegration of concrete is to provide adequate drainage and to waterproof the concrete where necessary. On the Lackawanna the most careful attention is given to the problem of drainage and waterproofing, drains being installed to carry off all water from fills retained by walls and abutments, and waterproofing being applied to keep dampness out of the concrete. All concrete bridge and trestle decks are pitched, waterproofed and provided with drains to shed water readily.

The waterproofing used varies with the conditions encountered. Integral waterproofing is considered suitable for waterproofing units which are not subject to temperature changes. Emulsified asphalt is the standard specification for waterproofing the back of units such as retaining walls, piers, abutments, etc., where there is little temperature change, or where the waterproofing is not called upon to resist water under a

Crossing of Van Houton Avenue, Passaic, N. J., Typical of the Concrete Structures on the Lackawanna

Emulsified asphalt was used on the columns supporting the approaches to the Lackawanna's Hackensack River Bridge to protect the concrete from the deteriorating effect of the gas-laden atmosphere in the vicinity

pressure head. Membrane waterproofing with suitable expansion joints is always used on the Lackawanna where the unit is subject to a considerable fluctuation in temperature or where the water is impressed on the concrete under a head. In all cases of the use of asphalt waterproofing, the waterproofing itself is protected against abrasion and the cutting action of ballast or other stones; special asphalt paving blocks being used on horizontal surfaces, and bricks for parapet protection, while cement plaster is used for protecting the waterproofing on other vertical surfaces.

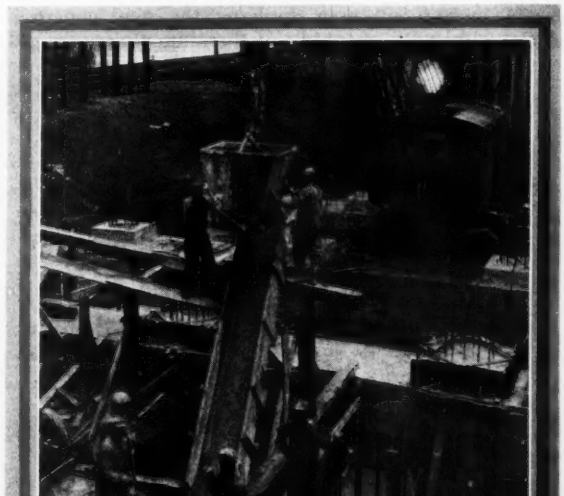
Sea water is known to have a serious deteriorating effect on concrete, and particularly on green concrete, and, therefore, the Lackawanna takes special precautions where sea water is encountered. In the first place, it feels that it is most important to keep such water from the concrete until it has fully set, if possible, for 30 days. It also recommends under such circumstances the use of extra-rich concrete, mixed fairly dry, using not more than five gallons of water to a bag of cement. Furthermore, it recommends the covering of all concrete subject to sea water with an asphalt material.

In much the same manner as acid or alkali-laden water, certain gases have a deteriorating effect upon concrete, and, therefore, concrete subject to these gases, either concentrated or contained in the air in any considerable quantity should be protected. For this purpose, also the Lackawanna has used emulsified asphalt, which has thus far proved effective.

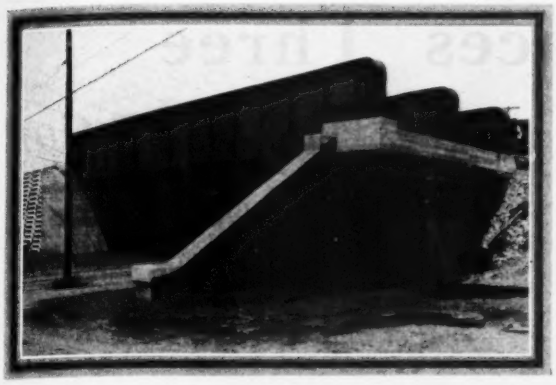
Inadequate Curing Causes Surface Defects

Entirely aside from these outside agencies, and often overlooked in concrete construction, the deterioration of the face of concrete is often due to poor workmanship and inadequate curing. In fact, it is the opinion of the concrete engineer of the Lackawanna that 75 per cent of the failures of concrete in vertical surfaces, not occasioned by structural design weaknesses, is due to inadequate curing during warm weather. Most engineers are very careful to provide the necessary precautions to secure properly cured concrete during cold weather, while, at the same time, they allow forms to be stripped from vertical surfaces after a minimum time limit during warm weather, and give no thought to keeping the concrete moist, a condition which is known to be essential to proper curing. In other words, the engineer who insists upon careful curing during cold weather, and who, likewise, insists upon securing adequately cured concrete in horizontal members by wetting down periodically, almost invariably fails to take the necessary precautions to cure adequately concrete laid in vertical or inclined members.

Much of the spalling off of the surface of concrete is also felt to be due to excessive spading and floating work which brings to the surface the richer mortar with a coefficient of expansion quite different from that of the concrete in the main body of the unit. This permits unequal strains in the concrete during expansion and contraction, and often results in the cracking away of the surface concrete. Thorough tamping and rodding of the concrete is felt to be much more desirable than spading in securing uniformly sound concrete. The Lackawanna feels that a properly designed vibrator used on the outside of the forms should prove highly effective in producing sound concrete all of the way



Strictest Supervision Attends the Mixing, Pouring and Curing of All Concrete on the Lackawanna



Emulsified Asphalt Waterproofing Is Standard Specification on the Lackawanna for the Backs of All Units Such as Retaining Walls, Piers and Abutments

to the surface, without the disadvantage which is frequently caused by excessive spading.

Methods of Repairing Surface Blemishes

Methods of repairing the surface disintegration of concrete, which has not penetrated sufficiently to impair the stability or permanence of the unit as a whole, consist essentially in the removal of all of the defective concrete and the placement of new concrete which will homogenize with the body of the unit and restore to it the strength and shape contemplated in the original design. The main problem involved in such work is to secure proper cohesion between the old concrete and the new.

Difficulties encountered in securing a proper bond between old and new concrete are most frequently due to the presence of foreign matter or disintegrated material on the face to be covered, and to the porous character of the old concrete which withdraws from the fresh concrete water necessary for proper hydration. To overcome these difficulties it is essential that all disintegrated concrete be thoroughly removed, and that the old concrete be saturated with water or a lean cement grout before the new concrete is applied. This method has been used successfully by the Lackawanna, but it also contemplates using at some time some of the special preparations which have been developed in recent years to apply to the face of the old concrete, with the idea of insuring a stronger bond.

Usually it is advisable to provide additional reinforcement in the new concrete to be placed to increase the bond between the old and new material, and in this work, exposed reinforcement in the original unit affords a convenient source for tying in the new reinforcement. Where none of the original reinforcement is encountered, steel dowels anchored in the old concrete should be resorted to in order to increase the strength of the bond. These dowels also serve as anchors for the reinforcing mesh which should be used near the surface of the new concrete put in place.

As in the case of all other concrete repair work, the relative quantities of the ingredients used in the old concrete should be considered in making the new concrete so as to produce a repair concrete with a coefficient of expansion as nearly equal to that of the old concrete as is possible. Where mortar is used for repairs, the proportions of cement and sand should correspond closely with those used in the original structure. The repair material may be applied by a wood float if desired, but it is felt by the Lackawanna that better results are secured by employing the Gunite process, which consists essentially of applying the new material under force by a special cement gun. Special care should be exercised in any concrete repair work carried out during cold weather, and every precaution should be taken to insure that the new concrete will be kept well above the freezing point and allowed to cure under the most favorable conditions.

Where not deteriorated to too great a depth, an effective substitute for repairing concrete by the addition of new material, would be to remove all of the disintegrated concrete, and to provide a bush-hammered surface over the face of the unit, removing such sound concrete on the unaffected parts of the surface as is necessary to give the bush-hammered areas some pleasing symmetrical design. This practice would restore the appearance of the unit and, at the same time, would preclude the possibility of subsequent spalling off of new concrete used in repair work.

All of the concrete work on the Lackawanna is carried out under the general direction of Geo. J. Ray, chief engineer, and J. L. Vogel, bridge engineer, and is under the direct supervision of M. Hirschthal, concrete engineer, to whom we are indebted for the information contained in this article.

Increased Traffic Handled with Less Equipment

WASHINGTON, D. C.

THE record freight traffic moved so far this year by the railroads, has been handled with fewer freight cars and locomotives than they have had at any time since 1923, according to a statement issued by the Car Service Division of the A. R. A.

Notwithstanding that fact, and the steady growth that has taken place in recent years in the industrial development of the nation, the railroads have been able to meet transportation requirements without car shortage except in a few isolated instances and then only of short duration. This achievement has been largely brought about by the steady increase in the capacity of freight cars and the power of locomotives, together with improved operating methods.

On July 1, this year, freight car ownership of the Class I railroads, excluding railroad controlled private refrigerator cars, totaled 2,266,069, a reduction of 98,603 cars under the greatest number ever owned in any one year, which was in September, 1925. Compared with July 1, 1928, the total ownership of Class I roads on July 1 this year was a decrease of 34,600.

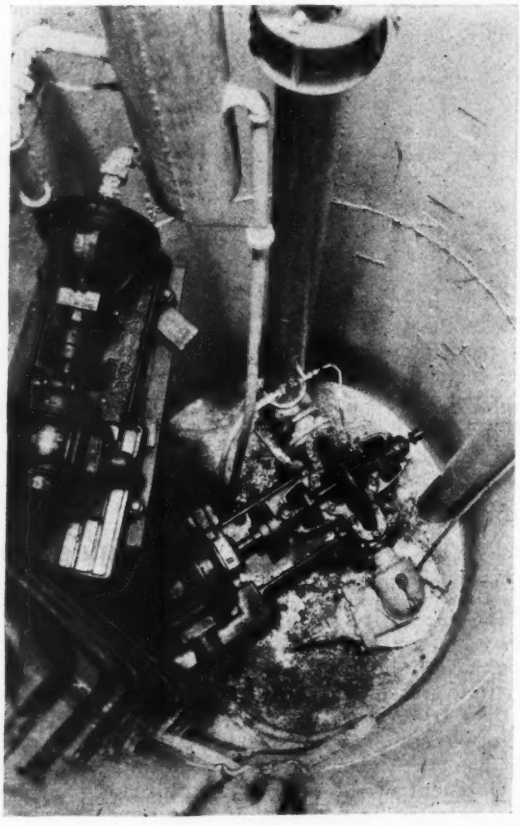
The same situation that prevails in regard to freight cars also applies to ownership of locomotives by the Class I railroads, which on July 1, this year, had 57,912 locomotives. This was a reduction of 7,012 compared with the number on July 1, 1924. Compared with July 1 last year, the number of locomotives owned on that date in 1929 was a reduction of 2,182.

With the decline in the number of units owned, there has been a steady increase in the tractive power of the new locomotives installed by the railroads with the result that the average tractive power per locomotive is now 43,985 pounds, compared with 38,217 pounds seven years ago. Through this reduction in the number of locomotives owned, the railroads have been able to retire many obsolete locomotives, while the increased power of the locomotives now in use enables them to move heavier loads of freight than formerly.

One Man Replaces Three *at Water Station*

Old facilities supplanted by automatic pumps that draw water from shallow wells in bed of gravel near site of terminal

By C. V. BUCHER
Division Engineer, New York Central,
Charleston, W. Va.



Looking Down Into One of the Pump Pits

AN unsatisfactory water supply and an inefficient pumping plant at the engine terminal and shops at Hobson, Ohio, caused the New York Central (Ohio Central Lines) to make a careful investigation for a source of better water. As a result, a new supply was discovered and an entirely new pumping plant was installed which embodies ingenious features designed to insure practically automatic operation.

The facilities at Hobson, which require approximately 600,000 gal. of water per day, are located on the north bank of the Ohio river, about two miles down stream from Middleport, Ohio, and immediately below the point where Leading creek flows into the river. At times, this creek contains considerable mine water and the water in this creek is, therefore, not suitable for railroad purposes. In times past, the water has been obtained from the Ohio river, being pumped by means of steam-driven reciprocating pumps.

The storage consists of two wooden water tanks, one of which is 20 ft. in diameter with 16-ft. staves, and the other 26 ft. in diameter with 20-ft. staves. The tops of the storage tanks are level and the two tanks are cross-connected so that the water in them is at a uniform elevation. From the storage tanks, water is distributed to water columns, to the boilers at the shops and to other points where it is needed.

The stage of the water in the Ohio river is subject to wide variation, as shown in the table below, which gives the stages in terms of elevation above sea level:

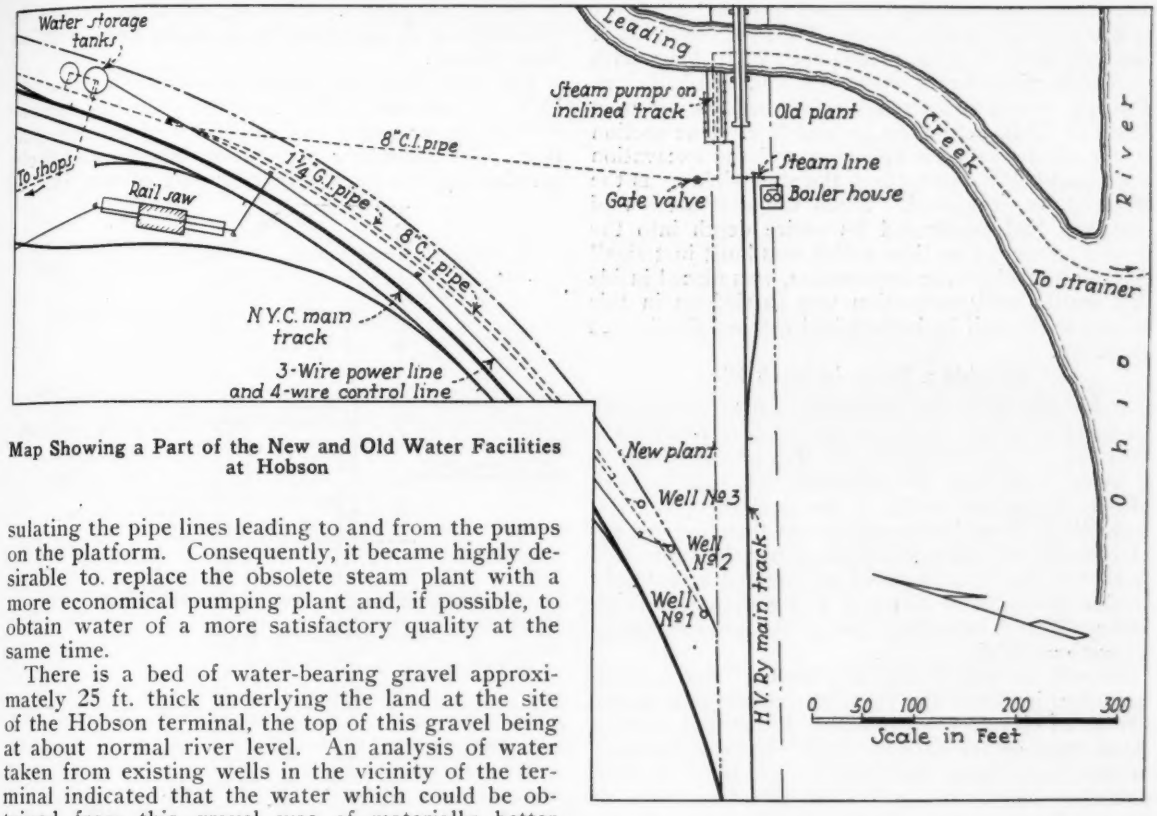
	Elevation
Low water	516.47
Normal river	524.47
Ordinary high water	569.00
Extreme flood stage	581.35

Various methods of arranging the pumping equipment have been employed to meet the conditions imposed by this range of water level. The latest and most satisfactory plant, prior to the installation of the facilities described here, consisted of a steam boiler with duplicate pumps, which were placed on inclines on which they could be moved up and down to meet the fluctuations in water level. An intake line extended about 950 ft. into the river, where it was capped at the end with a wire strainer. This line, which was laid partly in Leading creek and partly in the Ohio river, was constructed of 12-in. wrought iron pipe in 20-ft. lengths, all joints being made with Dressler couplings.

The water obtained by this plant was of a rather poor quality and contained considerable silt. Difficulty was also experienced in keeping the strainer in such condition that twigs and small floating particles would be eliminated from the water line. Furthermore, the 950-ft. intake line was extremely difficult to maintain in serviceable condition. Variation in the velocity of the river would cause the line to shift and the leaks which developed were difficult to repair. When the leaks occurred in or near Leading creek, considerable mine water containing sulphur, would at times be drawn into the pumps and delivered to the storage tanks for locomotive and boiler use.

Old Plant Was Uneconomical

The steam pumping plant was also uneconomical to operate, partly because the pumps on the incline did not always work at the most economical suction lift, and partly due to the fact that constant 24-hr. attendance was required. During cold weather, difficulty was also encountered in satisfactorily in-



Map Showing a Part of the New and Old Water Facilities at Hobson

sulating the pipe lines leading to and from the pumps on the platform. Consequently, it became highly desirable to replace the obsolete steam plant with a more economical pumping plant and, if possible, to obtain water of a more satisfactory quality at the same time.

There is a bed of water-bearing gravel approximately 25 ft. thick underlying the land at the site of the Hobson terminal, the top of this gravel being at about normal river level. An analysis of water taken from existing wells in the vicinity of the terminal indicated that the water which could be obtained from this gravel was of materially better quality than that obtained directly from the river. Accordingly, a test well was driven and a pumping test developed the fact that an ample supply of this water could be obtained if a sufficient number of wells were provided.

The scheme finally adopted to develop this supply was to drill three 12-in. wells to the bottom of the gravel stratum. Horizontal, electrically driven, centrifugal pumps with a capacity of 250 gal. per min. were installed at each well to handle the water. In order that these pumps could handle the water from the wells during seasons of low water, it was necessary to set them approximately 35 ft. below ground level. This was accomplished by providing a pit five feet in diameter at each well, with the bottom of the pit at the desired elevation. The method of constructing these pits will be explained later.

These pumps are controlled by float switches located on the storage tanks. Three switches are provided, one for each pump. The first switch starts one pump when the water has dropped two feet below the top of the tanks; the second switch starts another pump when the water has dropped to four feet below the top of the tanks; and the third switch will start the third pump when the water has dropped six feet. During periods of minimum use of water, one pump supplies the entire demand of the terminal and the water seldom gets so low that three pumps are operated.

Part of the Yard at Hobson, Showing the Three Wells in the Foreground

Operate Pumps in Turn

In order to distribute the duty equally over the three pumps, suitable switching arrangements are provided in the control house which is located over well No. 2 (the center well), by means of which the sequence in which the pumps and wells come into operation can be varied. Instructions are issued to change this sequence every 10 days. Between the first and tenth of the month, the wells go into service in the order of 1, 2, and 3. On the tenth, the switches are changed and the sequence is 2, 3 and 1. On the twentieth of the month, the switches are again changed and the sequence is 3, 1 and 2.

The driven wells have a 12-in. casing with brass Cook strainers, the latter being 11 in. in diameter and 12 ft. long. When the pumps are working at maximum capacity, the water in the wells drops about 12 ft., giving an average suction on the pumps of 15 ft.

At the point where the wells were driven, the general ground line is about at Elevation 561.5, or approximately six feet below the general elevation of the tracks and floors in the adjacent terminal. The wells were first drilled with a churn drill and cased; strainers were installed and the wells capped at the ground line. Work then proceeded on the construction of a concrete walled pit around each well to a depth of 36 ft. below the ground line. The lower 24 ft. was constructed inside a steel shell which

serves as water proofing and also provided a caisson in carrying on the excavation. The shell consisted of two cylinders of ¼-in. plates, each 12 ft. long, with an inside diameter of about six and one-half feet. The pit was constructed by first excavating to a depth of 12 ft. below the ground line. One section of the shell was then up-ended and the excavation continued below the bottom, the shell sinking as the material was removed. When the first section of the shell had penetrated its entire depth into the ground, a second section, which was built just small enough to go into the first section, was placed inside this section and excavation was carried on in this second shell until its bottom had reached the desired elevation.

Provide a Sump in Each Pit

Below the elevation of the floor of the pit, a small sump of 3 ft. 8 in. inside diameter, was provided to drain away water which might seep into the pit from a loose connection or otherwise. A steel bottom, closely fitting the inside of the steel shell, and also providing a form for the sump, was then inserted and electrically welded to the shell. After the entire steel shell and the bottom had been welded water-tight, a nine-inch wall of concrete was constructed inside the shell and extending above the ground line to Elevation 569.5.

It will be noted that the tops of the concrete cylinders in which the pumping apparatus is placed, are at an elevation considerably lower than extreme flood stage on the adjacent river. Increased expense would have been involved if the tops of these cylinders had been placed at an elevation above extreme flood stage. However, the tops of the cylinders were placed at an elevation sufficient to keep the pumping plant in service for any stage of high water that would permit the railroad leading into the terminal to be kept in operation. It is expected that at rare intervals, the cylinders will be over-topped and flooded. The Ohio river rises and falls comparatively slowly, and flooding of the pits can be anticipated well in advance, giving ample time for the removal of motors and for other protective measures.

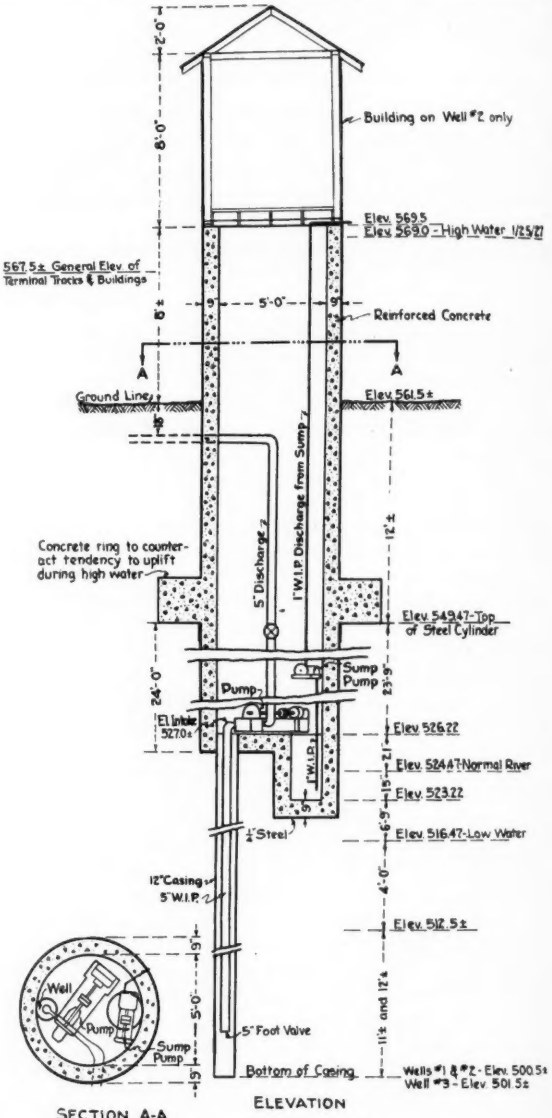
A control house was placed on top of the middle well, in which the switches and electrical control apparatus were placed. The two other wells were roofed and provided with ventilators.

The Equipment Provided

Each of the three pumping units consist of a Weinman, single-stage, double-suction, ball-bearing, centrifugal pump, direct connected to a General Electric, 15-hp., self-starting, induction motor. The pumps normally operate at 1740 r.p.m., using 3-phase, 60-cycle, 220-volt current. The pumping units are so designed that the motors can readily be disconnected and removed. In addition to being of advantage in case of flood, this also facilitates repairs. The pumps are controlled directly by magnetic switches located in the control house, these magnetic switches being actuated by the float switches on the water tank. Overload protection is incorporated in the magnetic switch.

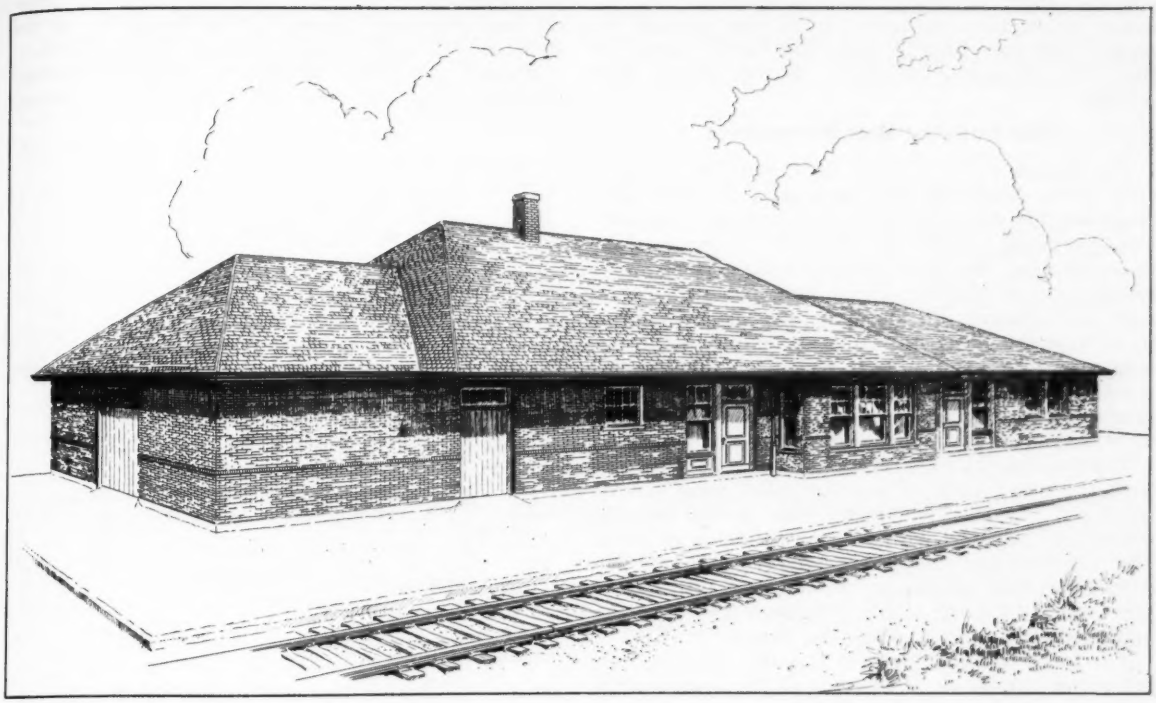
In order to take care of leakage, or water which might otherwise accumulate, each pit is provided with an automatically controlled sump pump, having a capacity of 50 gal. per min. These are horizontal, centrifugal pumps, driven by General Electric, one-horsepower induction motors. The pumps are controlled by magnetic switches which are actuated by floats in the sumps. Priming of these pumps is provided for by equipping each of the units with an Apco primer.

The new plant was placed in service on June 20, 1928, and service during the past year has demonstrated the economy and reliability of the installation. The automatic installation has been entirely satisfactory, the plant requiring part of the time of one man instead of the full time of three men with the steam-driven plant.



Details of Pump Pit and Well No. 2

Pumps used in the plant were furnished by the Weinman Pump Manufacturing Company of Columbus, Ohio. The motors and electrical equipment, with the exception of the float switches, were made by the General Electric Company. The float switches used on the tanks were made by the Electric Controller Manufacturing Company of Cleveland, Ohio. The work in the field was handled by the division maintenance forces and was in direct charge of R. L. Peters, supervisor of water stations; R. E. Rice, electrical supervisor; and J. W. O'Neill, supervisor of bridges and buildings.



Architect's Perspective of the Remodeled Station

As Good as New

Rock Island remodels old buildings and installs modern facilities at a marked saving compared with the cost of a new structure

OWING TO the remarkable growth in population which is taking place in many of the smaller towns in the western states, the railways are continually confronted with the demand that they replace large numbers of their older stations with modern structures that are more in keeping with the present civic importance of the various communities. To meet these demands in the face of steadily declining passenger revenues is an important problem that must be met and solved by the operating and engineering officers of the railways which serve this territory.

In common with all of the railways in this section, the Chicago, Rock Island & Pacific has a number of stations that, while they may be adequate in size for its present business, and in a good state of repair, are not modern in appearance and do not have the latest facilities for heating, lighting and sanitation. It has been the policy of this road for several years to make a study of each individual case as it arises and, where the building is in good condition structurally, to remodel it in such a way that it is modern in every respect, at the same time securing the maximum salvage from the old structure.

Remodeling Is Nearly Completed

One such station, the work of remodeling which is nearing completion, is located at Norton, Kan., in the northwest section of the state. This building was erected at the time that the Chicago, Kansas & Nebraska, a subsidiary of the Rock Island, was constructed in the late '80s, when the country was somewhat sparsely settled. At that time, however, Norton was a distributing point for a wide territory, and the railway furnished the only means of transportation to the older communities in the East and to the rapidly developing country to the west. Since the area of distribution from this place has been decreased from time to time by other means of transportation, the size of the station has remained ample to care for the business originating at this point, even with the increase in population which has taken place. For this reason, the plans for remodeling the structure did not contemplate any additional space, except such as was required for the purpose of installing rest and sanitary facilities.

The building in its original form was 22 ft. wide by 89 ft. 5 in. long and was supported on a foundation of rubble stone. It consisted of a freight room 40 ft. 5 in. long; a men's waiting room, 12 ft. wide; an office 16 ft. 5 in. wide, across the full width of the building, with small bay windows at both the front and back; and a women's waiting room 18 ft. wide. At a later period, an express room 8 ft. by 15 ft. 10 in. had been partitioned off in the freight room, adjacent to the men's waiting room and the front of the building.

The heat was furnished by two stoves, one in the women's waiting room and the other set in an opening in the partition between the men's waiting room

and the office. The latter arrangement was not entirely satisfactory, however, as it was difficult to secure sufficient heat to keep the farther parts of these two rooms comfortable during severe cold weather.

The Building Was Moved Back

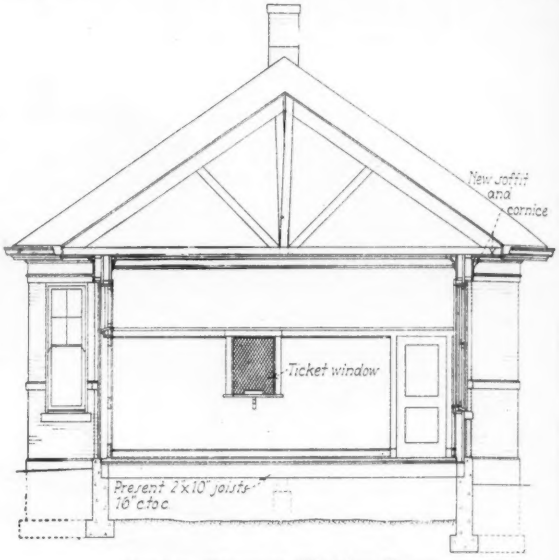
The platform was of brick, 12 ft. wide, with a concrete curb. Since the bay window on the track side projected 3 ft. from the face of the building, the platform here had a width of only 9 ft. In remodeling the structure, the bay window was enlarged and brought out an additional foot, and, as a wider platform was desired, the building was moved back 4 ft. to make the platform 16 ft. wide, except at the bay window where it is now 12 ft. wide. Concrete foundations were constructed to carry the building in its new location, with concrete piers to support the sills upon which the floor joists rest at interior points.

The building as constructed was a frame structure with the usual form of beveled siding and narrow windows. In the remodeling, this siding was removed and replaced with a veneered facing of brick. The windows and doors were enlarged and new and deeper window and door frames installed; larger glass was used in the sash and modern types of doors and hardware replaced the older types.

The brick which is used in the new building face is dark red or ox-blood in color, of the type usually designated as round-edge building pavers. It is manufactured locally from Kansas gas-belt shale and is fully vitrified. It was laid with black mortar and recessed joints. As the building is only veneered, the brick was laid in horizontal courses without resort to paneling or pattern work.

When the siding was removed, a layer of Celotex was placed over the studding before the brick was laid, for the purpose of insulating the building against extremes of temperature. This form of insulation was extended to include the plancia under the overhanging roof. The old cornices were removed and replaced with new wood cornices more in keeping with the appearance of the remodeled structure, and the plancia was relaid with new ceiling.

The original roof of the building had been replaced with a covering of asphalt shingles and, while this roofing had not yet reached the point where renewal was necessary, it did not correspond with the architectural treatment given to the remainder of the structure, so that it was removed and a new roof, composed of 300-lb. Mulehide, green individual shingles, was laid. Hanging gutters also replaced the old trough gutter, which consisted essentially of a narrow board set on edge and flashed. At the same time, the downspouts were renewed in such a manner that the roof drainage is led to a sewer and away from the building.

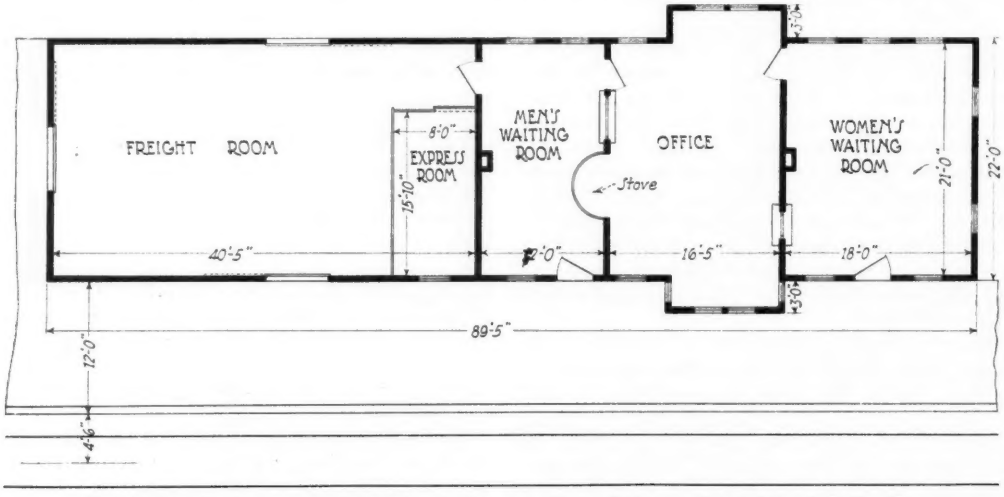


Section Through Waiting Room

Interior Completely Changed

In the interior of the building, equally drastic changes were made, without disturbing the existing arrangement, however, except for an extension of 13 ft. 5 in. adjacent to the women's waiting room, to provide space for a rest room and toilets, and such changes as were required to install the heating plant and the men's toilet. The express room was removed and these latter facilities are located in the space it had occupied previously between the men's waiting room and the freight room.

The plain plaster walls and wainscot base, and



Original Floor Plans of the Station at Norton, Kan., Chicago, Rock Island & Pacific

the plaster ceiling were removed and replaced with a new interior finish which consists of plaster which is broken up into panels by means of wood courses, a wood cornice and wood base board. The interior doors were removed and new door frames, in keeping with the wall treatment, and modern doors and hardware were substituted. The low, narrow ticket windows with lifting sash were replaced with larger and higher frames, in which the opening is protected by a heavy wire screen. A wide shelf, or ticket counter, was also built in at the base of this window frame. All of the interior woodwork is made from short leaf yellow pine which is finished in golden oak.

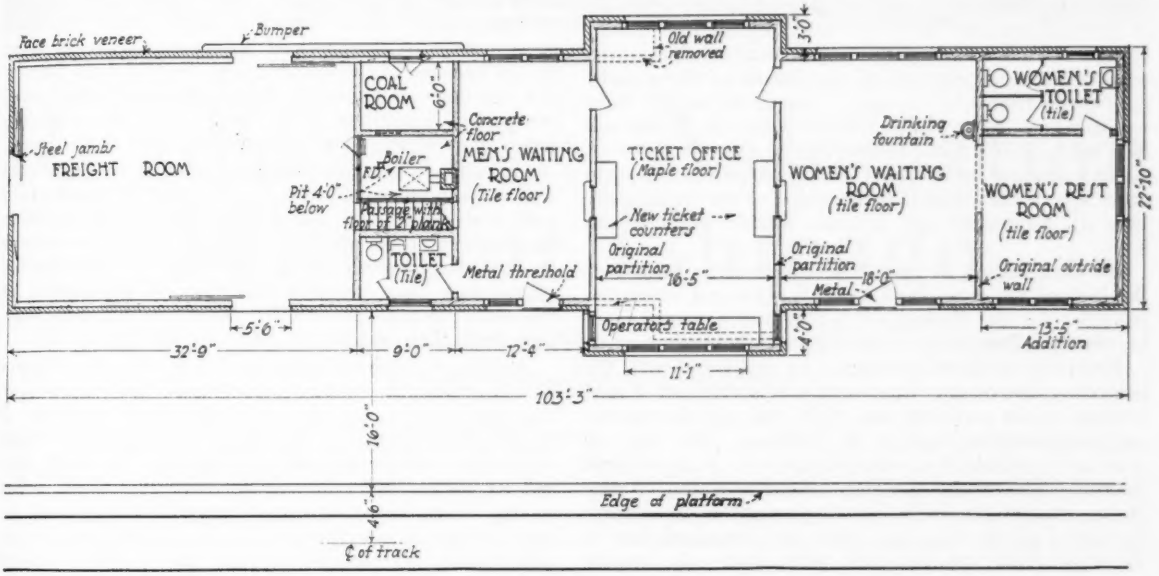
The wood floors in the waiting rooms were removed and a double layer wood base was laid over the floor joists. On this base the floor surface, which consists of red cement floor tile, was laid with close joints. A similar floor was also laid in the women's rest room and toilet and in the men's toilet. The old flooring in the ticket office, however, was replaced with a new maple floor laid on strips, as it was considered that this type of flooring would be more comfortable for the employees than the harder tile surface. All exterior door openings were provided with metal thresholds and safety treads.

One of the most satisfactory features of the remodeled station is the change in the method of heating. The stoves have been replaced with a hot-water heating system that is adequate to provide comfortable temperatures in all parts of the several rooms during the severest weather. The heating plant is so arranged that, while it is easy of access, it is complete separated and hidden from the space occupied by the passenger facilities. The boiler is set in a pit about four feet below the floor level, in a room adjacent to the men's waiting room and back of the men's toilet, from which it is separated by a passage 2 ft. 6 in. wide, that leads from the waiting room to the freight room. Back of the boiler room is a large coal room which is accessible for unloading coal from the driveway at the rear of the station. In order to provide ample draft for the new hot water boiler, the old chimney in the men's waiting room was removed and a new and larger chimney was built up from the ground. As there is no further need for the chimney in the women's waiting room this was removed also.

The entire building was wired for electric lighting, and fixtures to correspond with the treatment worked out for the interior will be installed. A drinking fountain is being installed in the women's waiting room to replace the antiquated water cooler.

Method of Handling

The method of handling projects of this type on the Rock Island depends on the local conditions as well as the character of the work involved. In some instances, such work is taken care of by the division building forces, and sometimes by contract. In those cases where the plans can not be completed until parts of the building have been removed to determine the full extent of the alterations that will be required, it is usually preferable to have the work handled by the local forces. In others where definite information can be secured it may be desirable to have it done by contractors.



Arrangement of the Station and Public Facilities at Norton, Kan., After Remodeling

When the station at Norton is completed, the railway will have what is to all intents and purposes a new station, of ample size to serve its requirements, with public facilities of the latest type, at a cost far less than that of a new building of the same dimensions, while the town will have secured a station that is satisfactory from the standpoints of appearance and civic pride.

The work of reconstructing this station was done under the general direction of W. H. Peterson, chief engineer. The plans were prepared by A. T. Hawk, engineer of buildings, who also supervised the construction. The information from which this article was prepared was furnished by Mr. Hawk.

FIFTY YEARS AGO—The New York Central & Hudson River Company has been building a number of small box cars which are carried on four wheels and are not more than two-thirds as long as the ordinary box car. It is expected that they will be very convenient for local traffic where the ordinary cars now have to be sent with only half a load.—*Railroad Gazette*, September 5, 1879.

Seams in Base Blamed for Fracture of Rail

THE derailment of an east-bound passenger train on the Atchison, Topeka & Santa Fe, near Yampai, Ariz., on March 13, 1928, in which the engineman, fireman and one mail clerk were killed and 27 passengers, 2 mail clerks and 2 employees were injured, was caused by a crescent-shaped break in the base of the receiving end of a rail on the high side of an 8 deg. 10 min. curve, according to a report by the Bureau of Safety of the Interstate Commerce Commission, dated March 25, 1929. The delay in issuing the report was occasioned by the fact that the investigation involved laboratory and research work on a number of rails which displayed seams in their bases.

The track on which the accident occurred was laid with 90-lb. rail, 33 ft. in length, rolled in 1920. Inspection of the track after the accident disclosed that six of the rails on the outside of the curve had been torn from the track and that the initial point of derailment was at the receiving end of the fourth of these rails, numbering from west to east, in the direction the train was moving. Four feet at the receiving end of this rail had been broken into several pieces, two or three of which could not be located. The testimony of the train crew was to the effect that the speed of the train at the time of derailment was between 20 and 30 miles an hour.

An examination as to the reasons for the failure of the broken rail was made by J. E. Howard, engineer-physicist for the Bureau of Safety and excerpts from his report follow.

From the evidence presented by the fragments, the primary cause of the derailment was a crescent-shaped fracture at the receiving end of the rail, and the attendant circumstances lead to the inference that the rail was in a weakened condition when the train entered upon it. The rail, on the high side of an 8 deg. 10 min. curve, was broken in the joint between the splice bars; the speed of the train was slow and fragmentation of the splice bars and rail took place under the engine, which took a tangential course.

This outline of what occurred at the time of the derailment is supported by the evidence presented by the fragments of rail 4. The receiving end of a fragment of this rail, matched in its position between the splice bars, showed one portion of a crescent-shaped break. The distance from this fragment to the end of the rail was three inches, representing a portion of the rail which was not recovered. The missing pieces can be reconstructed, since the recovered fragment is typical of this type of fracture and this type only.

Base fractures are commonly progressive, with an interval of time elapsing between their incipient formation and final rupture. They originate at a longitudinal seam in the lower surface of the base, thence extending gradually upward. A crescent-shaped piece of the base is eventually detached. The final stage of complete rupture is reached by the upward extension of the fracture through the web and the head. This review presents the reasons for thinking the derailment followed a pre-existing state of weakness in the track.

The lower surface of the base, as the rail appeared when in the track, gave no evidence of longitudinal seaminess, since the mill scale, a magnetic oxide, extended across and hid the surface manifestations. These were brought into view by pickling the fragment in hot hydrochloric acid.

It has been the experience in the examination of crescent-shaped base fractures that such fractures invariably start at a longitudinal seam. In some cases the seam was several hundredths of an inch in depth and displayed blue-black walls. Such a seam or lap, without doubt, was made during the fabrication of the rail. Other explanations have been offered for the presence of some of these manifestations. Short, intermittent lines have been attributed to the breaking through of small blowholes which had formed near the surface when the ingot was cast. The effects of seams would be minimized if those of the base could be restricted to the edges of the flanges. Little danger to a rail attends the detachment of a small crescent-shaped fragment from the edge of the flange, as such fractures do not extend inward laterally to the web.

Tests of bases of rails, by crosswise binding the flanges, display a high degree of strength, apparently in excess of service requirements. Such results, however, furnish additional examples of the remote relations between primitive static tests and the endurance of repeated strains of service. Variations in the state of seaminess of the bases of different rails, from those nearly immune to those extremely charged with numerous and deep seams, would appear to indicate that some control of conditions at the mill was possible during fabrication which would restrain their formation.

Cases have been presented in which base seaminess was so pronounced that fragments could be knocked off with a sledge at will, almost anywhere. On the other hand, crescent breaks have been started by seaminess in the base, directly under the web, of such limited extent that only complete and absolute elimination of the seams would appear effectual against ultimate rupture from that cause.

A sharp re-entering angle, as well known, is a menace to all grades of carbon steels which are exposed to repeated stresses, and especially alternating stresses. It is probably safe to say also that it is menacing to steels exposed to shocks and vibratory stress. The metal may not be weaker inherently at the root of a sharp seam, it may even be stronger by reason of attached reenforcement of adjacent metal, but vibratory strains are interrupted and intensified at such places. Shocks, wave motions, and vibratory strains are common to railway track and equipment, and these factors lead to certain kinds of fractures.

Knowledge of how to read fractures, to identify their points of inception and determine the direction in which they traverse the member is acquired so easily that a correct diagnosis of most fractures should be made, but such a method of procedure is seldom followed. Ordinarily fractured material is submitted for test to determine whether its physical properties meet the specifications under which it was purchased, no attention being paid to the features responsible for its rupture; an open book, but not read. A great waste of effort constantly goes on in these retests of material. Tensile tests, Brinell hardness, chemical composition and examination of microstructure comprise the usual range of laboratory tests for fractured material. They have no specific relation to the cause of rupture when, for example, the reason for rupture was the presence of a seam in the steel. Equally untrustworthy is attributing the primitive fracture to a location in the rail where only secondary results could take place.

In summarizing his report, Mr. Howard said: "This derailment again brings to notice a danger zone in the length of the rail not shown by electric track circuits and hidden from view against track inspection; namely, the short section between the bond wires and covered by the splice plates."

More than 600 Persons Attended the Eighteenth Annual Dinner

Roadmasters' Association Meets at Chicago

Excellent papers and reports were presented at annual convention —Large attendance a feature

THE forty-seventh annual convention of the Roadmasters' and Maintenance of Way Association, which was held at Hotel Stevens, Chicago, on September 17, 18 and 19, was in many ways, an outstanding one in the history of that organization. The attendance was large, 407 members and visitors being recorded on the registration list, not including members of the families of roadmasters, who accompanied them to the convention. The program was a diversified one, covering a wide variety of subjects of present-day interest to officers of track maintenance. The committee reports were of a high standard, being on the whole much more complete in their scope than those presented at any previous meeting.

In addition to five committee reports, the program included papers on pertinent subjects by four ranking railway officers and Charles W. Gennet, Jr., vice-president of the Sperry Rail Service Corporation, who reviewed the results obtained with the transverse fissure detector car. H. S. Clarke, engineer maintenance of way, Delaware & Hudson, read a paper on the Stabilization of Maintenance of Way Forces. R. H. Ford, assistant chief engineer, Chicago, Rock Island & Pacific, presented an address on the New Day in Maintenance. R. S. Belcher, manager of treating plants, Atchison, Topeka & Santa Fe System, discussed the Production and Care of Cross-Ties, while M. M. Backus, assistant chief engineer maintenance of way, Illinois Central System, spoke on Getting the Most from Labor-Saving Equipment. At the annual banquet given by the Track Supply Association to the Roadmasters on Wednesday evening, the principal speaker was L. A. Downs, president of the Illinois Central. This dinner was enjoyed by 632 roadmasters, members of their families and other guests. The exhibit of the Track Supply Association, which has been a feature of these conventions for many years, was given under usually favorable auspices. This exhibit is described in detail elsewhere in these columns.

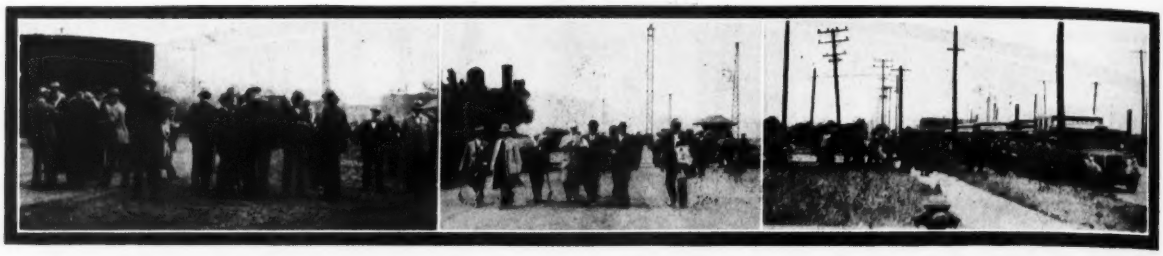
The convention was called to order by the President, H. R. Clarke, general inspector of permanent way, Chicago, Burlington & Quincy, who introduced W. F. Thiehoff, general manager, Chicago, Burlington & Quincy as the first speaker of the program.

The Opening Address

Mr. Thiehoff spoke in parts as follows:

Many responsibilities are imposed on you as teachers and leaders, which make it necessary for you to be studious in your daily activities, so that you may establish confidence by and through your teaching. You must be experienced in the things you suggest for you can be reasonably sure that an inexperienced officer or employee cannot successfully teach and supervise employees experienced in their line of duty. However, one may be seasoned in the service, and experienced, yet fail in his effort to direct the activities of others, unless he can teach them to employ methods and co-ordinate energies so as to produce economically and efficiently, and gradually bring them to understand the principles and policies that make for progress.

We must understand human nature. If our temperaments were alike; if our minds generated the same thoughts; if we were satisfied with the same entertainment; recognized the requirements of natural and legislative laws alike; had the same ambitions, there would be no need for teachers or supervisors—there would be no progress. But human



Several Groups of the 242 Roadmasters and Guests at the Inland Steel Company's Plant Thursday Afternoon

nature is a conglomerate complex, an amusing and serious bunch of dispositions, qualifications and possibilities; some are reticent and resentful; some confiding and optimistic; some sober and industrious; some joyous and easy-going; some saving, others spendthrifts; some careful, others careless; some studious, others sluggards; some require driving, others coaxing; all of us require encouragement.

Every employment should hold out hope to the employee of betterment, advancement, promotion, based on the result of his individual effort. Constructive criticism is sometimes necessary, and usually received by the right thinking employee as a special benefit, by and through which he can improve his methods and profit by his experience.

Perhaps we find it necessary to administer discipline. What is discipline? It is the premium we pay on an insurance policy covering safe and efficient operation.

Who should be disciplined?

First of all, ourselves. We should understand the need for self-control. If we are prone to be self-willed, stubborn, unkind, resentful, complaining, let us correct these faults. If we are ill-tempered, consider the effect it has on our own disposition and peace of mind and then multiply this by the number of employees we supervise or associate with and I am sure we will be so alarmed at the result that we will immediately make correction and by so doing, prepare ourselves better to understand when and how discipline should be administered.

There are, and perhaps always will be, individual employees who think discipline is personal punishment, administered by supervisory officers because of personal dislike or favoritism. So it is our duty to understand well the rules and requirements of the service; give consideration to the experience, development and capability of the employee and to his disposition to render service, and when we apply corrective measures by administering discipline, to explain to the employee his violation of rules so he may understand the need for a change in his methods or practices and his disposition to serve. Every employee has the right to protection for himself and family against the willful carelessness of other employees, and the employer has the right to protection against wasteful and inefficient practices of employees.

The President's Address

Abstracts from President Clarke's address follow:

The Roadmasters and Maintenance of Way Association of America has the distinction of being the oldest association of its kind. It has been active for a longer period than any other societies or organizations devoted to the consideration of the problems arising in the maintenance of the railroads of this country and Canada. This is the forty-seventh annual convention of our association. That it has survived so long is a tribute to the soundness of the ideals of the founders and the firm foundation they laid. That it is today more active, stronger and more influential than ever before is evidence that the present membership measures up to the standard set and that it intends to take no backward step, but is determined to push on to the solving of the more difficult problems encountered every day as the responsibilities placed on our members become greater and the complexity of our work increases.

Our association is an organization of practical men. It is our purpose to present to our members some of the problems, questions and difficulties encountered in the maintenance of the railroads of America and to offer, if possible, a solution of the problems and a means of overcoming the difficulties. This is our primary object.

Membership in our association, attendance at the conventions and taking part in the work of the organization present an opportunity to realize the vital part transportation plays in the welfare of the country, and to see and know the important place the maintenance department has in that great industry and to understand that in addition to the responsibility that is ours directly,—the maintenance of a safe roadway,—we have a further duty in helping solve the problems confronting the railroads in their relation with the public and with regulatory commissions.

Taxes have increased and multiplied and apparently the end is not in sight. Competition is becoming more keen, not only the competition of the private automobile, but of trucks and buses, subsidized by being allowed to operate without curtailment or regulation, on highways built at public expense, and to a large extent by taxes paid by the railroads, without adequate return for the privilege. Many roads are meeting this condition by entering this field, generally through subsidiary companies. Barge transportation on waterways constructed and maintained by taxes and using terminals financed in the same way and stimulated by legislation requiring the railroads to put in effect joint rail and water rates will almost certainly divert traffic formerly handled by rail over the entire distance.

The fight to reduce rates and the demand for faster and more frequent service is unending. The elimination of grade crossings involves large expenditures with little direct return and this burden is rapidly increasing.

Confidence and co-operation cannot be built on any other basis than that of mutual understanding and such understanding can be obtained only by the constant interchange of trustworthy information and intelligent discussion. The public is fair when it knows the facts and understands them. We should be familiar with the more important problems which are faced today by the management of the railroads

and be prepared to do our part to bring about a just and favorable solution.

Closing Business

According to the report of the Secretary, T. F. Donahoe, general supervisor of track, Baltimore & Ohio, Pittsburgh, Pa., 198 new members were taken in to the association during the past year, bringing the total membership to 894. The report of the Treasurer, James Sweeney, supervisor, Chicago & Eastern Illinois, indicated that the finances are in excellent shape.

In the election of officers First Vice-President, Earl E. Crowley, roadmaster, Delaware & Hudson, Oneonta, N. Y., and Second Vice-President, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago, were advanced to president and first vice-president, respectively, while C. W. Baldridge, assistant engineer, Atchison, Topeka & Santa Fe, Chicago, was elected second vice-president. Secretary Donahoe and Treasurer Sweeney were re-elected. E. P. Safford, supervisor, New York Central, Silver Creek, N. Y., was elected director for one year (to fill a vacancy) and J. J. Desmond, roadmaster, Illinois Central, Chicago, and A. Chinn, district engineer maintenance of way, Chicago, Burlington & Quincy, Lincoln, Neb., were elected directors for four years. It was decided to hold the next convention at Chicago.

Following the close of the convention on Thursday afternoon, the convention party proceeded by special train over the Chicago, South Shore & South Bend to Indiana Harbor, where, following an excellent luncheon, a tour was made of the plant of the Inland Steel Company, for the purpose of observing the manufacture of steel and the rolling of rails.

All of the papers and addresses presented at the convention are given below, either in full or in abstract, except for the papers presented by R. S. Belcher and R. H. Ford, which will appear in a later issue.

The Selection and Training of Foremen

REPORT OF COMMITTEE

G. T. Donahue
Chairman

THE maintenance of track is a large business. The foundation of any business is confidence, which springs from integrity, fair dealing, loyalty, efficient service and mutual benefit. Equitable consideration is due in any business, alike to management, employees and the public. Obligation to itself and its community prompts any business unceasingly to strive toward continuity of operation, bettering conditions of employment and thereby increasing the efficiency and opportunities of individual employees, which in turn increase the efficiency of the business.

The success of a track maintenance organization depends upon the degree with which it meets the above requisites of good business and that degree is measured to a great extent by the training and efficiency of its track foremen. Their development is a major problem and one to test the ability and judgment of a supervisor as well as to determine the standard of his track maintenance.

The natural development of this subject falls into three transitional periods, which your committee believes to be equally important, and which we list as follows, namely:

First Period—Reason for and method of attracting desirable men. Procedure followed to find men with the natural qualifications to become leaders.

Second Period—Character and length of training and testing periods for prospective foremen.

Third Period—Appointment of prospective leaders as foremen and developing them into efficient foremen. Methods of training and increasing their interest in progressive track work.

We will discuss them in the order listed above, with our recommendations.

(1-A) Reason for Attracting More Desirable Men

The railroads of this country are operated more efficiently today than ever before. In order to attain this efficiency we know that the managements of our respective systems require more intensive training and constructive thought than in the past. This training has to be a characteristic that is possessed in a certain ratio down through the personnel of the various departments; the track department is no exception. We must, therefore, attract a certain percentage of men to our ranks, who possess the natural qualifications and the education required as a foundation from which this efficiency may be developed, within a reasonable amount of time and at a reasonable expenditure.

(1-B) Method of Attracting Desirable Men

In order to attract men of the above type, a road must offer an incentive; either an opportunity for advancement from the rank of laborer, a steady position the year round or attractive wages. The track laborer's wage in the past has often not been as attractive as it might have been and we have left the other two alternatives. Along with these there are many other attractive features of other than a mercenary character, among which we recommend the following for your consideration.

1.—Create differentials in hourly rates of pay for laborers, based on length of service, at least one differential of one or two cents being paid per hour after a continuous service for six months or a year, the period to be governed by local conditions.

2.—Establish a good reputation in the local communities as an organization which recognizes the just claims of its laborers.

3.—Give systematic promotion to those qualified, proper weight being given to ability and seniority.

4.—Yearly employment for at least a sufficient number of men to form a nucleus of a good track organization, thereby creating an incentive for an industrious man to enter your employment. (This paragraph does not mean maintaining uniform track forces.)

5.—Liberal pass privileges to track laborers, foremen and their families, thereby stimulating a loyalty

which is worth much, not only in dollars and cents but in morale and which costs the road practically nothing. It is surprising what pride and keen satisfaction liberal pass privileges create.

6.—Clean bunkhouses and good food in boarding camps.

7.—Up-to-date labor saving devices and good tools kept in first-class condition.

(1-C) Methods of Detecting Suitable Timber for Development into Track Foremen

The choosing of a man as a prospective candidate for a foreman and his development should be given just as much thought and supervision as he receives after he is appointed a foreman. It is easier to teach a man to do work right as he learns it than it is to try to break him of a habit after he has acquired his own way of doing the task.

Where the personnel of the regular organization of track maintenance forces is losing the type of men from which good foremen can be developed, it follows that some special effort or system must be followed in order to be able to fill the vacancies that occur among these foremen. As in anything that attains an efficient stage, there must be a system and the picking of prospective foremen is no exception. If a supervisor is to build up a good organization, he must pick his men and pick them right.

There are, no doubt, many parts of our country where there are plenty of young men native to the communities through which the railroad passes, and here it is not so difficult to get good track men. But there are many other localities where track work is performed principally by foreign laborers in both section and extra gangs. This may be in industrial centers or in thinly populated areas. Here the problem becomes most acute. In the latter localities the supervisor must have some system or method for discovering suitable men.

On some roads, the supervisors build up their organizations by personal observation of good men, picking and training them practically by themselves. Under present labor conditions and increased duties for supervisors, however, we believe that lack of time prevents a supervisor from doing his organization justice in this direction and some other system of selecting men is preferable.

A foreman should be made to understand that the developing of foremen is included among his duties and that its successful performance is as much to his credit as any other duty he performs. He should be made to realize that any form of jealousy is unwarranted and not worthy of him if he is a worthwhile foreman.

Regardless of the method used in selecting prospective foremen we believe that the man one picks as a candidate should possess the following natural qualifications which, in their order of importance are:

1. Character and Habits.
2. Willingness to work.
3. Education.
4. Experience.
5. Thoroughness and Safety.
6. Resourcefulness.
7. Suitable age and physical condition.

(2-A) Combination of Apprentice and Assistant Foreman

Each roadmaster's district should have apprentice foremen the number depending upon the length and characteristics of his division. As soon as they pass the physical examination they receive an increase in wages over the other laborers with whom they are working. This differential creates more interest than anything else. As soon as the apprentice foreman has sufficient training, he is sent out as a relief or an assistant foreman. In the majority of cases, relief or apprentice foremen are given positions as assistants in extra gangs during the summer. This gives them experience in the various kinds of work necessary in running various sections. While in the gang he meets conditions that make him think and do things for himself. He is also confronted with various working conditions that he will not meet while running a section. If it is decided that the man is not capable of becoming a competent and successful foreman, he is dropped from the list of apprentice foremen and the roadmaster then selects the next best man. Experience shows that more than half of these men fail to make good foremen.

The assistant foreman has a chance to bid on any foreman's position that is advertised. When an assistant foreman is appointed to a section, a relief or apprentice foreman bids on the opening created by the assistant foreman's promotion. This system really amounts to a training school for assistant foremen and we believe that it is very good since a man receives special attention very early in his service.

(2-B) Student Foremen

Young track laborers with a good common school education who desire to become track foremen are picked as candidates for student foremen. They are placed as laborers in gangs under experienced track foremen who have a high rating on track work, but not necessarily much education. When one of these student foremen has progressed in his work so that he knows how to perform the duties of a track foreman, he is given an examination. This consists of a physical test in addition to an examination on the book of rules, flagging, signals, safety first rules, proper methods of rendering reports, etc. Each man receives a rating and, if satisfactory, he is qualified as a student foreman, by a committee consisting of the general roadmaster, the division roadmaster and two members of the track supervisory organization. He is then placed as a student foreman in a gang doing regular section maintenance work. Later he is transferred to extra gangs handling heavier types of work, such as laying rail, spacing ties, ballasting and switch work. He is required to keep the time, make out reports and handle the clerical duties of the regular foreman under whom he works. He is paid a flat monthly rate for all service rendered. The committee believes that this is a very good method as these men are taught both the track and report work.

Section and extra gang positions are classified and the rates are graduated. When a student foreman advances to the position of a regular foreman he is given a minor position and has a higher rate to look forward to.

(2-C) Leading Laborer and Assistant Foreman

The positions of leading laborer and of assistant foreman, the latter with a higher rate than the former, and the former with a rate higher than those of the rest of the gang, are means by which interest is stimulated among the men and an opportunity given to supervisors to choose those best fitted to be made foremen. The choice of a man for

the position of leading laborer receives the utmost deliberation. No man is chosen unless it is reasonably sure that he will qualify for the higher rate of assistant foreman, and then become a section foreman. Each section and extra gang should have a rate for a leading laborer as an inducement for deserving and capable men to stay with the company and strive for further advancement. Year-round work should go with such a rate.

As a man is serving as leading laborer on a section, he is getting daily experience in routine maintenance work. After a period of time, depending largely on himself, he should be well versed in the installation of ties, surfacing, lining and the many other duties which make up the daily program of section work. Simultaneously he is taught how to make out daily reports, with the proper distribution of labor and material.

The heavier work such as laying rail, the installation of turnouts, building new tracks, ballasting, etc., is done in the extra or floating gangs. This work is done many times without the aid of section gangs. In this work there is valuable experience. In such gangs, there are assistant foreman rates which are available for the leading laborers who, in the opinion of the supervisor, have proved themselves capable of holding such positions.

When a man has served as assistant foreman in an extra, floating or work train gang for a considerable length of time, he has received a varied experience in all types of work with which a section foreman will come into contact. He has been trained in all rules pertaining to the doing of the work, as well as the operating rules which may be involved. During this time he has had an opportunity to familiarize himself with the railroad's standards. During this period the supervisor should spend as much time as possible with the assistant foreman, describing the methods of doing work, and explaining all problems which the assistant foreman should feel free to ask about. A class of instruction is not necessary in the training of these men as they work under competent foremen. The supervisor has their interests at heart, and a prospective foreman will not lack for instruction and training in the duties and responsibilities which go with the position.

Up to this time prospective section foremen have worked for the most part under the direct supervision of qualified foremen and have not had a great deal of experience "on their own." In large yards and terminals one foreman is generally in charge and it is necessary for him to have assistant foremen to handle some of the work which he himself has not the time to direct. His section may be such that he has three or four assistant foremen whose duty it would be to maintain certain portions of the yard or terminal. After having served as a "leading laborer," and then as an assistant foreman in an extra, floating or work train gang, a man is given an opportunity to act as assistant foreman in a large yard or terminal where his handling of work with his own men will soon demonstrate whether he is competent to be made a foreman.

In the above methods of picking and training men for the position of track foremen, all does not depend upon the merits of the system or on the man himself. A supervisor is generally as good as his organization. If he has a straight-forward man of proper age and in good physical condition, who is ambitious, progressive and interested in his work, it is up to the supervisor to take that man in hand and see that he is properly and consistently trained

Herbert R. Clarke
President

Mr. Clarke is in a position to view the problems of the association from the standpoint of a staff officer as well as a man on the firing line, for while he is now the system maintenance of way officer of his road, the Chicago, Burlington & Quincy, he has seen eleven years of active service in the positions of extra-gang foreman, roadmaster and general roadmaster. He entered the employ of the Burlington in 1907 as a rodman. Later in the same year he was advanced to instrumentman and in the following year he was promoted to extra-gang foreman. A year later he left track work temporarily to serve as a resident engineer on construction. He was promoted to roadmaster in 1911 and eight years later he was advanced to general roadmaster of the McCook division. Again in 1921 he was promoted to engineer maintenance of way of the Nebraska district and in 1925 to general inspector of permanent way of the Burlington system, his present position. Mr. Clarke joined the association in 1920 and after serving as a committee member and a committee chairman, was elected a member of the executive committee in 1924, second vice-president in 1926 and thereafter in turn first vice-president and president.

in the various branches of the work, according to the system practiced on that road.

In any of the methods leading to the creation of a foreman, the committee recommends the following suggestions for consideration.

1—Differentials in rate of pay above that of a laborer.

2—Rotation among sections of different types of work, such as branch line and yard sections, extra gangs, main line sections, terminals and inter-locking plants.

3—Qualifying on flagging under different necessities.

4—Training in the correct manner of making out various reports, as well as correct methods of doing various kinds of track work.

5—Practicing "Safety First" rules.

(3-A) Appointment of Prospective Leaders as Foremen and Their Development

When a man has apparently passed through the necessary training and is appointed a track foreman, it should be as an acting foreman. In other words, he should be told that he is on trial and he should be encouraged to ask for information as to his work. He should be given to understand that his appointment as a foreman does not mean that his working days are over and that he should stand around, as many newly appointed foremen seem to think. The probation period for a newly appointed foreman has a tendency to be too short and the committee believes that it should be increased over that now used. Railroads having agreement with the Brotherhood of Maintenance of Way Employees have in some instances probation periods of from 30 to 60 days, and we suggest that longer probation periods be granted so as to more justly determine a candidate's actual fitness.

When any corporation increases a man's pay it expects increased results. Of course, in some localities where traffic is dense, a foreman cannot do much work, but on the majority of the sections of the country he should not only work, but should set the pace, both as to amount and quality. He should realize that this is really the critical stage in his progress and that he must apply himself diligently so as to do his work efficiently and produce work of good quality and increasing quantity as time progresses, quality being the prime requisite. The supervisor should work closely with the new foreman, acting as a teacher and guide and giving him necessary instructions.

The fact that an applicant has passed all tests successfully does not mean that he should be forgotten. It is in this period that he may most easily become discouraged with his own ability, even though his ability may be above the average. The supervisor should program the foreman's work for him, making it continuous and systematic, thereby giving the foreman an opportunity to think in advance and thus aiding in developing him. Gradually, according to the progress made, the supervisor can relinquish considerable of his personal attention and allow the foreman to assume his own initiative.

Noticeable advance is made in unformity of track maintenance where group meetings of section foremen and prospective foremen are held frequently at regular intervals, for the discussion of all phases and methods of doing seasonal work, as well as meeting emergency problems requiring special flagging, rendering derailment reports, etc. It is evident that when 30 or 40 foremen get together there will be an exchange of valuable ideas in the same manner that ideas are the motive for a gathering of track supervisors. The track supervisor can accomplish greater results in less time by such a meeting than by any other method.

Taking a foreman over his own section on the rear of a fast train will often convince him more readily than words that his track is not as uniform or as smooth as he thinks. Walking with him over his section, pointing out specific defects is also very beneficial. The amount of written instructions and circulars which should be issued should be given careful consideration and kept to a minimum consistent with absolute necessity. Means should be adopted to simplify daily reports and eliminate all unnecessary correspondence, so that a foreman can devote his full time and attention to track work. It must be realized while the office forces have been augmented to handle the increase in these reports, the foreman alone is the man who originates them.

The average foreman has no conception of the actual cost of the new material he is using or the salvage value of the material he is removing. He should, therefore, be told the unit prices of his materials, for this will often cause him to respond to appeals for economy quicker than any other line of approach. He should likewise be told the reason for doing a piece of work one way rather than another so that he will be convinced that this is no arbitrary whim of an officer.

He should also be given some idea of the keen competition between different roads in the delivery of materials and passengers so that he will realize what delays to trains mean, both at derailments and from slow orders.

(3-B) Maintaining and Increasing Foreman's Interest in Progressive Track Work

The committee recommends the following suggestions.

1—Frequent joint meetings of the supervisor with his foremen and assistant foremen for the general discussion of track work.

2—Inspection of the division by a committee of foremen.

3—Inspection of track on various divisions by officers, grading them according to their class and publishing these marks, so that they reach each foreman. Each foreman's attention should be called to that particular phase of his work in which his mark was low, to assist him in bringing that particular branch of his work up to standard.

4—Awarding of cash prizes to those foremen having the best sections in their respective classes.

5—Encouraging the reading of up-to-date periodicals.

The responsibility of track foremen, as brought out by this report, analyzed from any angle of his natural or acquired ability, his supervision of a large number of men, his handling of material involving large capital as well as his responsibility for the safety of the lives and shipments of the public, demand that he be given his proper place among the subordinate officers on our railroads.

In the past he has not been classed or given the consideration that should be rendered one with his responsibilities. If we demand, we must also give. He must be given all the consideration that men in other departments with equal responsibility receive.

A good track organization is one in which there

are always available a couple of qualified men capable of handling a foreman's position.

G. T. Donahue, chairman, assistant division engineer, N. Y. C.; P. J. McAndrews, vice-chairman, roadmaster, C. & N. W.; P. Chicoine, roadmaster, C. P. R.; A. A. Cross, assistant division engineer, N. Y. N. H. & H.; M. A. Davidson, roadmaster, U. P.; J. Kielty, roadmaster, D. L. & W.; E. F. Manson, division engineer, C. R. I. & P.; and Z. L. Mobley, roadmaster, Southern; M. H. Murphy, roadmaster, C. & A.; W. L. Spyres, roadmaster, K. C. S.

Discussion

A. M. Clough (N. Y. C.) said that, if we are to train men from the track gangs for the position of section foremen, we must have material to start with. He has experienced considerable trouble in getting young men with ambition, who are willing to undertake the hard work and put in the time required to secure promotion in the maintenance organization. In the opinion of A. L. Kleine, (A. T. & S. F.) the time of probation for new foremen should not be more than 60 days as a supervisor should be able to determine the qualifications of a man in that time.

C. W. Baldridge (A. T. & S. F.) thought that the length of the probationary period should depend very largely on the conditions with which the man is surrounded. It is his opinion that, if he were placed on the reduced salary during the probationary period, then the time during which he is on probation should be shortened, in order to be fair with him. During the probationary period he is ordinarily required to perform the same duties and assume the same responsibilities as he will later when accepted as a full-fledged foreman. If he is on full pay during this time, then as a matter of fairness to the man, the probationary period can be extended somewhat.

An explanation for the committee was offered by P. J. McAndrews (C. & N. W.), who stated that some railways have agreements with the brotherhood which stipulate that a man can be placed on trial for any position for a period of 30 days, but that after that period he cannot be demoted and, if he is not satisfactory, the only resort is to discharge him. It was the feeling of the committee that, where such agreements exist, the terms relative to the trial period should be changed to permit of longer probationary service. It was the opinion of the committee that it would be better if the period were extended beyond 30 days, since it is not always possible to determine a man's qualifications in so short a time. If he is unable to qualify in a longer period, it is better to demote him either permanently or temporarily in order to retain the advantage of the expense of his training.

T. F. Donahoe (B. & O.) said that it is not his understanding that, where roads have agreements with their men, it is the intention that a man shall be dismissed if he is unable to qualify for a position to which he may be promoted, but that the probation-

Earl E. Crowley
First Vice-President

T. F. Donahoe
Secretary

Roadmasters' Association

Officers, 1928-1929

HERBERT R. CLARKE, President, General Inspector Permanent Way, C. B. & Q., Chicago.

EARL E. CROWLEY, First Vice-President, Roadmaster, D. & H., Oneonta, N. Y.

ELMER T. HOWSON, Second Vice-President, Editor, *Railway Engineering and Maintenance*, Chicago.

T. F. DONAHOE, Secretary, General Supervisor, B. & O., Pittsburgh, Pa.

JAMES SWEENEY, Treasurer, Supervisor, C. & E. I., Danville, Ill.

Excutive Committee

J. P. DAVIS, Past President.

(Terms Expire September, 1932)

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(Terms Expire September, 1930)

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F. J. MEYER, Assistant Engineer, N. Y. O. & W., Middletown, N. Y.

(Terms Expire September, 1929)

C. W. BALDRIDGE, Assistant Engineer, A. T. & S. F., Chicago.

J. J. DESMOND, Roadmaster, I. C., Chicago.

Elmer T. Howson
Second Vice-President

James Sweeney
Treasurer

ary period is only a period of trial to see whether he can qualify. If he is unable to do so, the man should be put back into the gang and when he is developed further he should be given a second trial.

E. T. Howson *(Railway Engineering and Maintenance)* called attention to the important feature of the report which is that it lays down a deliberate plan for building up an organization in contrast with the practice, so common, of relying on chance. It recommends an organized plan for training men so that they will be ready to step into positions when vacancies occur. This is a scientific method of building up a desirable organization. Maintenance practices are changing to such an extent that no hit and miss method can longer be successful. In his opinion this committee has developed a plan for building up an organization in a scientific way, and every roadmaster should take these suggestions home and act upon them.

J. Barth (C. C. C. & St. L) said that any plan for a probationary period should provide that, if a man is unable to qualify within 60 days, he can be demoted, without losing his seniority. If he is retained beyond the probationary period, then his seniority may be lost and in the demotion he may be required to go back to the bottom of the seniority list. But, since it is not always possible to determine a man's qualifications when promoted during the winter months, at this time the probationary period should be made longer.

Recent Developments in the Detection of Transverse Fissures in Rails

By C. W. GENNET, JR.
Vice-President, Sperry Rail Service Corporation, Chicago

C. W. Gennet, Jr.

SINGULARLY it was just a year ago, almost to a day, that the trial tests of the first detector car for locating and recording fissures in rails were made on the main line tracks of the New York Central at Beacon, N. Y. The tests being satisfactory, the car was accepted by the Rail committee of the A. R. E. A. as being a "practical device for the detection of transverse fissures in track." In the course of the year this A. R. A. car has tested some 2,000 miles of track on a number of different railroads. The service company with which I am connected, now has three other cars in daily operation and a fourth nearly ready to start, while the fifth will be working in 30 days. The year old car has, therefore, done very well, and its first anniversary is celebrated with you in this manner with distinct pleasure and satisfaction.

The struggle for a way of detecting fissures has been an uphill one. For a number of years following the Lehigh Valley wreck on August 25, 1911, when 29 people were killed because of a fissure, most of the effort was centered on the hope of finding the cause for fissures and eliminating them at the source —a means for effecting a cure such as was made in Panama where fevers were conquered by controlling the cause. Considerable headway was made and a lot of facts were established through the collection of a mass of tests, data and statistics. But metallurgists seemed to forget that if a definite cause were found, it could hardly be applied to the existing rails of the 280,000 miles of main-line tracks, so that the lurking menace of fissures on these existing lines would still be tremendously important. While Dr. Sperry's experiments were taking tangible form, it probably remained for the Frisco accident, which killed 21 people in October, 1925, to give the necessary impetus to the solution of this vital matter; for soon after this arrangements were completed whereby the American Railway Association through the Rail committee, ultimately came into the possession of the first detector car ever constructed. While the mills grind slow, they certainly grind, and although it took 17 years to get a practical device for detecting fissures in track, it is now an accomplished fact.

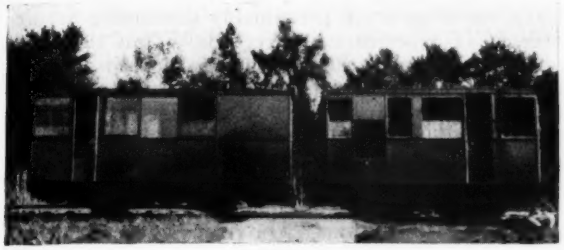
Rail Is a Complex Structure

Modern rails consist of a hard and almost brittle steel rolled into a peculiar, unsymmetrical section. The steel lends itself easily to heat treatment, meaning that widely different physical characteristics can be easily produced by simple means. The unsymmetrical section, comprising the large mass of head metal and the thin web and base, is such as easily to acquire internal strains of an unusual extent.

A Well Developed Transverse Fissure

This combination is unique in rolled steel products and it must not be surprising or disappointing if metallurgists and physicists fail to solve quickly all of the problems raised concerning rails.

A discussion of the cause of fissures has become tiresome and monotonous, and yet every one is naturally curious about this puzzling question. Any discussion of it consists of mulling over the evidence collected, first, by those who regard the cause as due to a defect inherent in the rails when they leave the mill, and, second, by those who stand by the metal but allege that the traffic over the rails is really the actuating cause for an interior rupture, or crack, which grows into a fissure. The only thing



Sperry Transverse Fissue Detector Outfit

that every one apparently agrees on is that fissures develop, or enlarge in size, under continued traffic. Argument along the lines just mentioned is by no means complete, and no one can safely predict which side will finally have to assume responsibility for fissures. Personally it appears to me (as it always has) as likely that the mill is fundamentally, but quite unintentionally, to blame; for seemingly some condition must occur during the fabrication of rails that introduces certain peculiarities in various rails from which fissures later develop.

Many Questions Unanswered

Exactly what that evil condition may be is a highly speculative matter, for, after all, comparatively little is known of the actual causes for the various defects that occur in rails. For instance, just why should two or three blows of a spike maul on the five-eighths inch web of a rail be apt to start a crack in the web as service continues? Why is a small nick in a piece of steel invariably a bid for a break later on? Maybe these are trivial questions, but I mention them by way of showing that not only may fractures come from trivial causes, but that the attempt to locate the definite cause of some fractures may often be complicated because both the manufacture and the use of modern high-carbon rails is so involved.

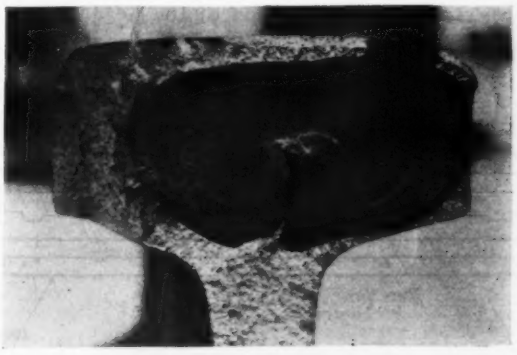
It is the greatest folly to assume that every rail of an ingot is of exactly the same character throughout, merely because of having been accepted under even the most rigid specifications for chemistry and physical tests. Two brothers, perhaps twins by birth, may be radically dissimilar, not because of their physical make-up, but because of a mysterious thing called "character." Likewise, two rails, perhaps originally adjacent in the same ingot, may give totally different service under traffic and the task of finding a definite reason for that is just about as difficult as attempting to assign a cause for the difference in the twins.

Indications now point so plainly to the occasional presence in new rails of what are freely called "shattered zones," and to the rather rapid development of these minute interior cracks into fissures, that I feel disposed to repeat the earlier suggestion that the mill, or the method, is primarily responsible for the introduction of some condition into the hard steel of unsymmetrical section that causes these little cracks. Thus one twin rail may be rendered different from its brother, depending on some slight difference of treatment during manufacture.

How We Are Finding Fissures

Of much greater interest than the cause of fissures is an account of how we are finding them and what we are finding. A description of the detector car seems quite unnecessary, for it would be but a repetition of what has been published before. It should be emphasized, however, that, as with any new device, no pattern for which has previously existed, changes in design and construction have been and are frequent. A certain amount of experimental work, and of trial methods and design, is constantly necessary, requiring time and patience, and to an extent, sometimes retarding operation. For this we have to beg leniency, but thankfully we have always been in the hands of sympathetic railroad friends who have been ready to extend helpful and constructive assistance.

The three cars now operated by us have tested practically 5,000 miles of track. The number of miles tested per day varies widely, depending on the condition of the surface of the rail under test, the traffic conditions encountered, and the time lost for making repairs, although this latter item is being so constantly decreased that it can now be virtually ignored. We have tested over 30 miles on a number of different days, and then we have run onto long stretches of the well known corrugated or washboard rails and operations have been terribly upset. This corrugated rail, so common to street railways, is, I think, much more prevalent on steam roads than has been supposed, and sooner or later the time will

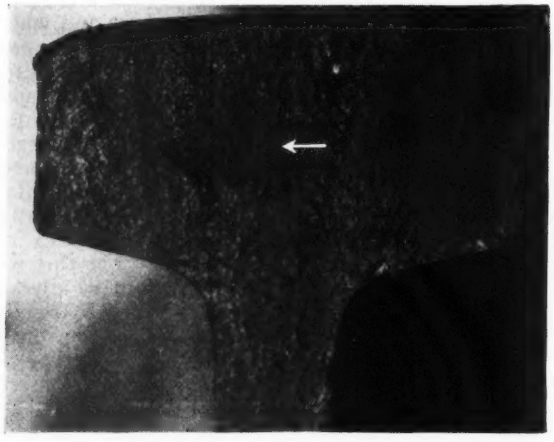


A Large Transverse Fissure

come when a study of its cause and cure will be important. It retards testing because the detector can not follow the hills and valleys of the uneven surface of the rail with the precision desired, and false indications constantly occur, making it necessary to repeat and check the tests frequently. Our engineers have been working desperately to overcome the trouble and we hope some recent changes in design may prove as lastingly beneficial as the early trials lead us to expect. Traffic is always a disturbing factor to the speed of testing, and as a rule from 15 to 20 per cent of the time on the road may be occupied in getting the equipment out of the

way of trains, but this loss can be considerably decreased on double-track lines by co-operation from the dispatchers.

One of the most interesting and perhaps surprising incidents of the operation of the detector cars has been the fact that many other defects in addition to fissures are so easily located and recorded. Developed primarily as a means for locating and recording fissures, the car was hardly expected to detect much of anything else, for one of the early principles



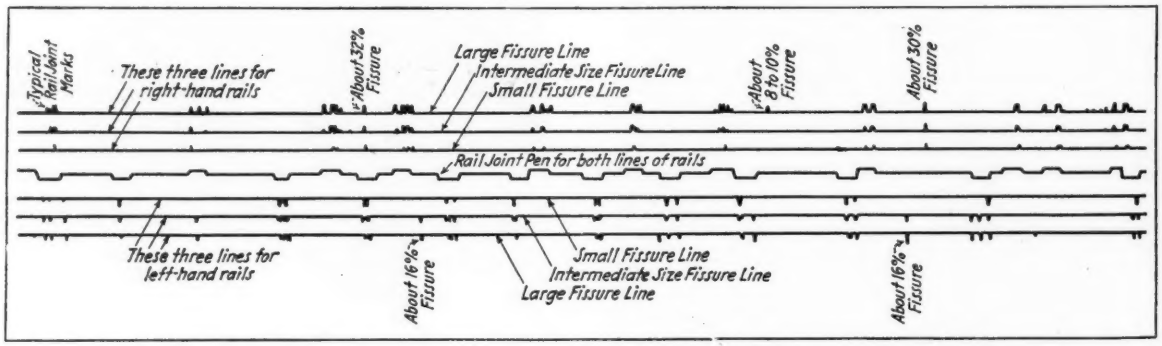
Incipient Split Head Discovered by the Detector Car

appeared to be that defects could only be located when they were transverse to the direction of the electric current. The complete change in the design of the actual detector first used at Beacon has greatly enlarged the scope, or field, of the car's utility, for we are now actually "picking up" quite as many defects of other types as we are of fissures and the value of the detector car has, therefore, been very greatly enhanced. These defects include split heads and sometimes what are probably real pipes, cracked webs, cracks at the junction of the head and web, what proved to be a serious crack several feet in length at the junction of the head and web, and which I think it will be conceded was nearly as hazardous as a fissure might sometimes be.

Defects in 1,000 Miles of Track

It would not be right even if it were possible, to give figures showing the number of fissures and other defects that the detector cars find. Such figures in the hands of the uninitiated could do considerable damage, and naturally the confidence of the roads for whom we have done the work should be respected. Moreover, almost any set of figures obtainable might be misleading, for the fact remains that the detector car has generally been assigned to test suspicious track, meaning track presumably containing fissures because of experience and records. Thus the detector car may only reach an infected locality and the number of fissures found may therefore be much greater proportionately than if the whole system had been tested. Notwithstanding the circumstances, I am taking the liberty of giving some results for practically 1,000 miles of tested track on different lines with different kinds and ages of rail laid under different track conditions. On this mileage we found 116 transverse fissures, 66 horizontal fissures and 234 other defective rails. Thus, there was one transverse fissure in every 9 miles, one horizontal fissure in every 15 miles and one other bad rail in every 4 miles, or one seriously defective rail every 2.4 miles.

To me the alarming phase of the whole situation is not with respect to the number of fissures and other defects found, but especially with respect to the size of some of the transverse fissures located. A great many rails are taken from track and broken immediately after the detector locates a fissure. Thus the awful truth is often revealed, and hence the frequent surprise that the defective rail gave safe passage to the last train. Many of the fissures found are bright and shiny, "air-tight," as they are called, and lack only a little from coming to the surface, yet they are often larger than a silver dollar in area



Section of the Continuous Record, with Notations Explaining the Meaning of the Markings

and the so-called horizontal fissures. One of the best arguments our men have had while testing was caused by a split head in the very early stage of formation; the operator claiming that the rail contained an interior defect, but not a fissure, and the railroad man being skeptical because no exterior sign of the split head could be found. Breaking the rail, easily and happily proved the accuracy of the detector and the admiration of the skeptic was won. Another interesting case was found at a highway crossing where planking concealed the complete rail section from view. There the detector car told of and unquestionably must reduce the strength of the rail most seriously. We have found them chiefly during the warm or hot weather, and whether a rail containing a large fissure would have carried the last train safely in the cold winter weather is indeed a problem.

This naturally raises the question of how fast fissures grow. On that there are no reliable data, but we know that under ordinary conditions of traffic the growth may be faster than supposed. We have reason, from a few sporadic cases, to think that fissures may readily double in size within 60 days of normal

traffic but that is purely a random statement easily subject to change. James E. Howard, whose statements must always be given the greatest respect, made an air-tight fissure grow to the surface by comparatively few blows of a light hammer. Tests are badly needed in order that a rule of thumb formula can be established which will give some idea of the probable rate of growth in terms of the number of tons of traffic.

The operation of detector cars, like the cars themselves, is in its infancy. Our men learn something new almost every day, and their exchange of ideas and experiences is most valuable. Surely as time goes on and with a little courage and patience, the cars and their operations will be so greatly perfected that fissures and other interior defects will cease to be the menace to safe railroad transportation that has been the case in recent years.

Discussion

C. W. Barnes, expert for the A. R. E. A. rail committee said that the detector car was proving valuable in making track more safe. The detector car that is owned by the A. R. A. has tested 2,200 track miles and in the course of this test an average of about one transverse or compound fissure has been detected by the machine per 10 miles of track. In addition to this many other defects, including moon breaks in the base have been discovered.

In a typical month the car covered 396 track miles or an average of about 14 miles per day. During this month no maintenance expense was required and the total delays for adjustments amounted to 40 min. A total of 195 rails were removed because of defects of which 46 were fissures.

Fortunately only a small proportion of the failures of rails caused by transverse fissures result in accidents. Rail failure records reported annually to the A. R. E. A. by the railroads include about 5,400 fissure failures. This, of course, takes no account of the incipient fissures that have not been detected.

In the opinion of Mr. Barnes, the development of transverse fissures may be much more rapid than was formerly supposed. The nucleus from which the fissure starts may remain dormant for a long time and then develop suddenly as a consequence of some change in conditions such as a marked increase in traffic or a period of poor maintenance. While the operation of the transverse fissure detector gives assurance that all fissures of a dangerous size have been discovered this does not mean that other fissures will not develop subsequently. Unfortunately it is not now possible to estimate how soon such fissures will grow to a dangerous size.

C. B. Bronson (N. Y. C.) said that the number of removals of rails made as a consequence of the operation of the detector car were not nearly as great as some engineers had supposed. Studies made as the result of such operations show that all rails are not susceptible to the conditions which produce fissures, a fact which has convinced him that the underlying cause lies in some unknown defect in mill practice. The subject is now being given most intensive study by the rail mills and it is hoped that means will be found for the production of better steel.

The Correction of Unsafe Methods in Track Work

REPORT OF COMMITTEE

G. H. Warfel
Chairman

TO AFFORD ready reference to items of immediate interest to the reader, the following outline is included, and the text is arranged in corresponding sequence:

A. Track cars (Motor, hand and trucking cars).
   1. Care and repair.
   2. How to prevent collisions.
   3. How to avoid road crossing accidents.
   4. Handling of men and tools on cars.
   5. Handling of car itself.

B. Handling of ties on sections.
   1. Loading into and unloading from cars and piles.
   2. Distribution by train.
   3. Distributing by track cars.
   4. Renewing ties in track.

C. Handling rails, frogs and switches on sections.
   1. Loading into and unloading from cars and piles.
   2. Trucking on track cars.
   3. Making individual renewals in track.
   4. Cutting rails.
   5. Driving expansion.
   6. Gaging track.

D. General rail renewal work.
   1. Distributing material.
   2. Laying track and switches.
   3. Picking up released and surplus material.

E. New track construction.
   1. Distributing material.
   2. Laying track and switches (not covered by D-2).

F. Ballast work.
   1. Cleaning old ballast.
   2. Unloading and spreading ballast.

G. Care and manipulation of tools to prevent accidents.
   1. Track jacks.
   2. Claw bars.
   3. Mauls and sledges.
   4. Cutting chisels and punches.
   5. Wrenches.
   6. Lining and prying bars.
   7. Picks.
   8. Shovels.
   9. Adzes and axes.
   10. Scythes.

H. General.

A. Track Cars

The question as to what rules should govern the operation of track cars, the mechanical safeguards that should be applied, operating methods, etc., have already been treated in other papers. (See the Proceedings of the American Railway Engineering Association, 1927 meeting, page 415, also the report of the committee on "The Control of Motor Car Operation, with Respect to the Prevention of Accidents," 1928 Proceedings, American Railway Bridge and Building Association.)

A-1. Care and Repair

The mechanical safety of cars depends upon their regular and thorough inspection in the field, the prompt correction of minor defects by the user, the immediate reporting and removal of a car from service when a serious defect is discovered, its repair

in the field by a competent mechanic if can be done economically, or complete overhauling at a central shop if major repairs are necessary.

The roadmaster or supervising officer should frequently make a personal examination of the cars used by his men. A weekly cleaning up and tightening of loose nuts, connections, etc., should be required; the roadmaster can readily tell by a five minute inspection whether this is being done. His personal check-up is essential to prevent neglect of company-owned cars by some men, and is his best assurance against accident due to poor brakes, a balky engine or worn and loose running gear. He must also check the quality of work done by the traveling repairman, or the shop, and insist upon it being up to standard.

A-2. How to Prevent Collisions

Collisions result from failure to maintain a proper lookout, failure to flag or use torpedoes and fuses where the view is restricted, or failure to control the speed properly from the braking power of the moving car. Collisions of trains are due largely to the same causes. Surprise tests to ascertain whether train and engine men are complying literally with the requirements of rules, have been proved to be the most effective means of preventing train collisions, and likewise the most logical for preventing collisions between track cars and trains or other cars.

It is assumed, of course, that no track car is permitted to be put on the track or operated except under the personal charge of an examined and qualified track car operator; also that, on all gang cars, one or more men are regularly assigned to positions at the front and rear to keep a constant lookout for approaching trains, cars, or other hazards, assisting but not relieving the man in charge.

Roadmasters and all other supervisors in the maintenance of way department should be required to make a stated minimum number of surprise tests and checks on track car operation monthly, covering at least the following major points:

1. Full specified flagging equipment on every car, separated in a container, instantly accessible for quick use.
2. Flagging ahead on single track (and on double track where reversing of traffic is frequent), at all points where the view is obscured, unless a dispatcher's message or an automatic signal indication gives positive assurance that no train will be encountered.
3. Keeping the full distance back of a preceding flagman.
4. Placing cautionary torpedoes and stop signals or a flagman to protect from the rear where necessary, as in No. 2.
5. Effectiveness of lookout maintained.
6. Spacing of moving cars and speed control.

The roadmaster should make a trip each way over each section with the section gang, conferring with the foreman as to just what places on his section are or may be dangerous under any conditions, and deciding on the spot just what procedure is necessary to prevent any possibility of the car being struck—either flagging or sending a man to a point where a clear view of the track or governing automatic signal can be obtained. It should be decided whether protection for the car is necessary while waiting, and if so, how and where it is to be placed. The place for stopping the car should be at a landing or crossing, or a landing should be built if none is available.

A memorandum should be made of just what must be done at each such hazardous place, for movement in either direction, and a typed copy given to each foreman and made a matter of record in the roadmaster's office.

Having thus definitely determined just what will be required at doubtful points, it is necessary to know positively that the instructions are lived up to. This can only be done by frequent surprise tests. These take some ingenuity, patience and time, and firm determination. It means that a roadmaster must select a place and time when a gang will pass such a point, must get there unobserved, and take a position where he can see without being seen. This sounds like detective work, and that's just what it is, only the desire is to find out for sure that a man is doing right, instead of to catch him doing wrong.

As soon as the officer is satisfied that the performance under observation is right,—or wrong,—he should step out and reveal himself, and either commend or condemn the foreman on the spot. A few such incidents, talked about up and down the line, will quickly bring about uniformly good rule observance. The roadmaster must point out to all foremen that it is not any game of tag, or hide and seek. It is not a question of how "slick" the foreman is in evading detection,—it is a matter of saving life and property by 100 per cent performance.

On double track, the lookout maintained to the rear is a most important safeguard. This may be tested by remaining concealed under a bridge or at the side of the track until the motor car passes, then stepping out onto the track after the car is some distance by, and giving vigorous stop signals with a red flag, hat or coat. All men on motor cars should understand that such a signal requires an immediate stop and investigation.

Failure to observe classification signals displayed on an engine for a following section has often resulted in cars being struck. It is not the general practice for enginemen to call the trackmen's attention to these signals by the regular whistle signal, although that would be an effective safety measure. Some roadmasters make it a point to inquire frequently of a foreman whether a certain train carried signals, to discover if the foreman actually observed them. One instance is related of a roadmaster who noted a passenger train carrying signals, which was quite unusual. Finding the second section was several hours late, he turned back his motor car and followed the first train over his district to determine how many foremen noticed the signals. He found that 6 gangs out of 17 had failed to note them. Vigorous handling of this incident was of great educational value.

On both single and double or multiple tracks, where telephone dispatching is used, portable phone sets for track gangs enable them to get lineups and avoid loss of time in unnecessary flagging or waiting. Roadside phone booths serve this purpose also. Dispatchers and operators should give information clearly and plainly, and foremen must be sure that they understand it correctly.

The prevention of collisions between track cars is entirely a matter of a sharp lookout, maintaining the proper spacing between cars, and running slow enough where the view is obscured to be able to stop in less than half the distance that the track can be seen to be clear. These features can be surprise-checked more easily than the flagging.

A-3. How to Avoid Road Crossing Accidents

Unless he has a clear view of road approaches for an ample distance to assure his car getting across a crossing before the fastest auto could reach the crossing, the track car operator should stop his car and send a flagman out on the crossing. This flagman

should indicate when the track car should move and should stop highway traffic by a vigorous flag signal if necessary. Approaching all crossings, the speed of the track car must be so controlled as to enable it to stop short of the crossing if there is a possibility of auto traffic reaching it first, or of dirt or other obstruction being on the rails.

Again surprise checks afford the only effective means of knowing that these requirements are being observed. An excellent method is for the officer to approach the crossing in an auto as the track car appears, and see just what the men do. At almost any station an auto can be secured to make such a test, and when it is known that these tests are being made, and that discipline follows failure, the chance-taking will stop.

A-4. Handling of Men and Tools on Car

The supervisor should stop any car he may encounter going to or from work and see just how the men are seated and how the tools are stowed, commending, suggesting or criticising in the presence of the entire gang.

A-5. Handling of the Car

The supervisor should require each foreman to assign a definite place and duty to each man in putting the car on the track or removing it in an emergency. Occasionally when he encounters a gang moving on a motor car, he should require them to remove the car from the track quickly, then and there, and observe how they go about it. Many accidents occur through lack of training for such an emergency. Men should be taught to remove the car without the foreman's help, if possible, so that he can watch and order them back if the train gets too close.

Some other unsafe methods to be watched for and corrected are:

Trying to use motor cars on a high speed, busy track without well maintained, roomy landings at frequent intervals.

Carrying more men than can be seated properly on the motor and trailers.

Letting men stand on the ends of moving cars outside the safety hand-rails.

Sitting with feet or legs between or over the ends of coupled cars.

Letting inexperienced or clumsy men push the car and try to jump on.

Letting too many men try to help put the car on or off the track. Four men are usually enough for any car, six at the most.

Trying to help lift or turn the car by taking hold at the sides.

B-1. Loading and Unloading Ties

When a roadmaster is in the vicinity where ties are being handled, he should, if possible, approach the job unobserved and note whether the foreman is actually directing the work and watching the movements of the men. If so, it should be noted whether he is permitting unnecessary talking and hilarity, or whether the work is being done quietly and deliberately. If ties are being unloaded out of a car by one or more sets of men, see that their movements are so timed that one set does not interfere with the other when in the act of throwing ties, and that the men are keeping back out of the way of possible rebounds. In throwing ties out of coal cars, see that no chance is being taken of hands being caught between ties and the edge of the car. It is usually preferable to take hold of a tie well back from the ends, place the free end on the edge of the car, then step out of the way and let the men at the other end shove the tie over. There is less likelihood of injury by this method than by men taking hold of opposite ends and attempting to throw the tie over the side flat-wise. Men should not attempt to pick ties off the ground until the throwing of ties out of cars has stopped. It is better to lay ties carefully in position on a pile than to attempt to toss them into position. Piles should not be more than shoulder high so that it will be unnecessary to toss them to higher tiers. A hook similar to a bale-hook should be used to pull ties endwise part way out of tiers to permit men to get a safe hold with hands.

B-2. Distributing Ties by Train

When ties are being distributed along the track from a work train or local, the roadmaster should observe how signals are being passed and how the train is handled by the engineer, and see that a minimum of jerking and slack-taking occurs. He should also see that loads are being worked down evenly to prevent the possibility of ties being shaken or rolled down in the cars by the train movement. Men on the ground should not be allowed to walk alongside cars while ties are being unloaded, but should follow behind the last working car to pull back any ties that lie too close to the track. The roadmaster should see that only active and alert men are allowed in cars for such work. Ties should be slid from the cars so that they will fall in the direction of the train movement. There should be a foreman or designated leader in each car, charged with the safe conduct of the work in that car. Some roads do not now permit ties to be unloaded or handled while the train is moving, but throw off a number while the train is stopped, then move to a new spot and unload another bunch.

B-3. Distributing by Track Car

Ties should never be hauled on a motor car, but they may be hauled on a trucking car coupled to a motor car by a standard coupler. A roadmaster coming across such a gang so engaged should note definitely whether ample flag protection and stop signals are being used, as a truck car loaded with ties requires such protection, unless a positive line up has been secured from the dispatcher. He should also observe how the ties are loaded on the truck car, see that no attempt is made to throw ties off while this car is being pulled along by the track car, and that no man is permitted to stand up on the load of ties and tip them off the car while it is moving. It should also be noted whether there is any tendency to overload the trucking car and that it has been well oiled and is in good operating condition. The trucking car must always be pulled by the motor, never pushed. Some roads provide removable stakes, inserted in slots at the ends of the car, to prevent ties from shaking off, loading all ties crosswise. See that no ties are loaded higher than the stakes.

B-4. Renewing Ties in Track

Injuries occur most frequently in this work as the result of men falling while drawing ties in or out of the track or being struck by ties carried up from nearby and thrown from the shoulder. A supervisor coming up to such work should see whether tie tongs are being used to drag ties in and out of the track, that they are of the type that will afford a sure grip in either new or old wood, and that they are sharp and in good condition. He should observe whether any men are attempting to pull ties in or out of the track with a shovel blade and should take disciplinary action with the foreman if such a practice is being tolerated. Sharp picks may be used for dragging out

badly rotted ties if tie tongs will not hold securely. The supervisor should also note whether men drop ties or tools to the ground before looking to make sure that no one is in a position to be injured and warning them out of the way. He should also observe whether shovels are left lying with the blade turned up, or other tools so close under foot as to afford a stumbling hazard. He should also note whether dirt is leveled down between the rails on the approach of track cars and that all tools are removed from between the rails and the rail cleaned off for cars to pass. Require the track jack to be used to support the rail when applying tie plates instead of nipping the rail up with a bar which frequently slips, resulting in mashed fingers. Keep the men spaced well apart and require a man to look about him before swinging a pick, maul or other tool.

C-1. Loading and Unloading Rails

Rails and frogs should be handled to and from cars by a crane, magnet or other power equipment. In the heavier sections, frogs weigh so much that it is almost impossible to handle them safely by hand. When the roadmaster appears at the scene of such work he should observe whether the foreman is in a position to see and direct the moves being made. Not more than two men beside the foreman should be in a car under the derrick. No attempt should be made to lift a rail until it is completely freed from the rails in the car and the boom has been centered directly over it to prevent it from jumping or swinging sidewise. The safest and most efficient way to handle rail to or from cars by derrick is to so arrange the rails in even tiers in low side gondola cars, placing at least three wood strips between the tiers. Rails should preferably all be upright but they may be "balled in" evenly if considered necessary. This requires a little more time and care when loading released rail, but this time is amply repaid by the greater safety and speed in unloading of the rail. Some roads now have strict rules requiring this to be done in all cases except when loading scrap and short lengths which are to be unloaded at the scrap yard by a magnet. If the roadmaster has any control of the situation he should require all rail coming to him to be so loaded, and should load his own rail in like manner.

No attempt should be made to lift a rail while a train is passing on an adjacent track. Loading or unloading between tracks should not be done in a fog or stormy weather, with less than one mile clear vision. The derrick boom should be anchored or guyed securely while a train is passing on an adjacent track. Men must not be permitted to jump over a rail suspended under a derrick or to pass under it. All rails should, of course, be center marked for tongs. Tongs, cable and fastenings should be examined by the foreman and roadmaster frequently to detect wear or defects, but the engineer of a power hoist should understand that he is strictly responsible for the condition of all apparatus belonging with his hoist.

When seting rail between tracks, unless the ballast is troughed, the rail should be turned on its side to prevent its shifting and possibly fouling the adjacent track because of the vibration of passing trains. Rails, frogs and switch material should be placed as near as possible to the point where they will be used in track to reduce the hazard of rehandling by hand.

The roadmaster should observe the work of the man handling the hoist, as the prevention of accidents depends largely on his good judgment, coolness and constant watchfulness. He should be strictly under the jurisdiction of the foreman handling the men, should take signals only from one designated employee and should refuse to make any moves that appear to involve hazard.

C-2. Trucking Rails on Track Cars

Before attempting to load rail on a truck car, its wheels should be securely blocked. The roadmaster should provide, in advance, plenty of men to carry the rails by hand as it is usually easier to carry waist high by hand than with tongs. Men should be spaced at the ends, leaving the middle of the rail clear to rest on the car. After a rail is set on the car, one man at each end should do whatever shifting is necessary to get it in place, others getting away from the rail. The man at one end should keep his hands entirely clear while the man at the other end is moving it.

A trucking car loaded with rail should not be pulled by a motor car except in emergency and then only under full flag protection. Four rails may be arranged, two on each side in a "V" shape with the open end of the "V" toward the motor car to permit coupling. If more than four rails are to be hauled, two trucking cars should be used, with the front end of the rails even with the front end of the leading truck car to which the motor car is coupled. All movements should be at very slow speed. Men should not be permitted to ride on a truck car load of rail under any circumstances. If it is necessary to run through a spring rail or frog, the cars should, of course, be stopped and pushed through. Rails should not be hauled on motor cars.

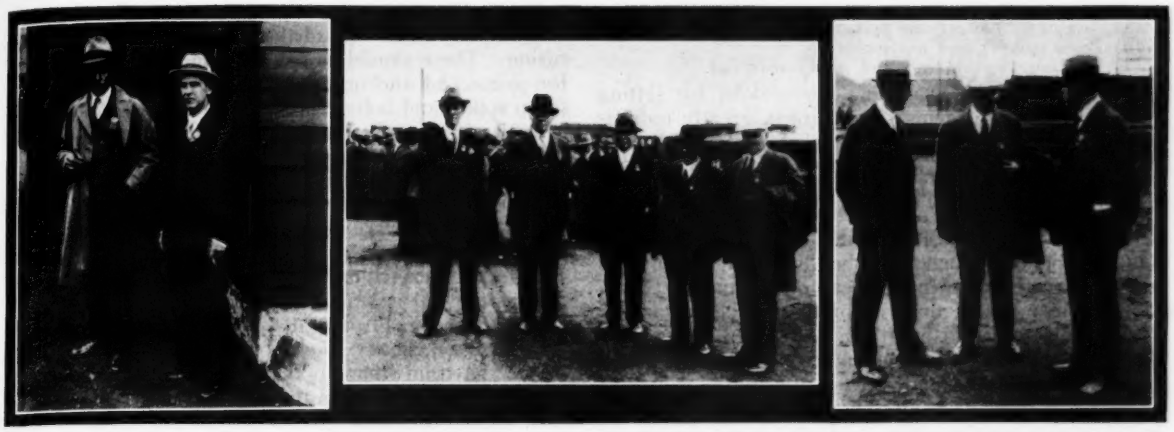
C-3. Making Individual Renewals in Tracks

Roadmasters should especially impress new foremen with the danger of attempting to make an individual rail change where steel is tight, without first securing ample expansion. It is better to leave a broken rail in track and protect the break by angle bars than to attempt to change it if the rail is tight. A slow order over such rail is better than complete interruption caused by inability to get new rail in place. Bolts should be removed by a wrench or by splitting the nut with a track chisel.

C-4. Cutting Rail

When it is necessary to cut a rail, cuts within three feet of the end should be made by cutting deeply with a chisel clear around the rail except across the top of the head, then inverting the rail with the cut over a piece of rail for an anvil and cutting deeply into the center of the base to finish the break.

If the cut is more than three feet from the end, cut deep notches in opposite sides of the base at points exactly opposite by measurement. The rail to be cut should be set between the track rails about twelve inches from the nearest one and blocked up under each end from 8 to 12 in. high. After notching both edges of the base as above, the rail should be turned on its side with the head toward the track rail and sprung down sharply by bars placed across it and under the track rail. The chisel should be placed in the uppermost notch and struck a heavy blow, as the rail is sprung down. A few blows should give a clean break. In summer it may be necessary to chisel a cut from the notch in the edge of the base to the center of the rail on the side nearest the track rail. It is also advisable to pour cold water over the rail around a cut, after it is well marked, before the final break is attempted.



At the left—Luis Reina, division engineer, and A. del Paso, assistant engineer maintenance of way, of the National Railways of Mexico. Center—Five past presidents, left to right—James Sweeney, J. B. Kelly, Tom Thompson, T. F. Donahoe and H. R. Clarke. Right—Vice-President Crowley, President Clarke and Vice-President Howson

The above method is much safer than old methods, which are still in vogue in some places, of marking the rail, then lifting it high above the men's heads and dropping it across a piece of rail for an anvil.

C-5. Driving Expansion

With sufficient rail anchors properly placed, it should not be necessary to drive expansion in ordinary work, but this sometimes has to be done in connection with individual rail renewals or connections around switches where renewals have been made. The usual method is to use a 10 or 12 ft. piece of rail as a ram against the side of an angle bar. The hazards to be looked out for are the danger of the ram passing by the end of the angle bar being struck, or the slipping of the bars or plates upon which the ram is being slid. A double end track wrench makes a good slide bar, slipping one end of the wrench over the head of a spike in the track and tacking a spike into the other end of the wrench to keep it from slipping. This is preferable to using a lining bar or a claw bar as a slide. The most experienced men should be placed on a pair of tongs near the striking end to guide and watch to see that the end does not become so battered as to slip by easily.

C-6. Gaging Tracks

There are no particular hazards in connection with this work not already covered in other sections.

D-1. Distributing Material for Rail Renewal Work

The unloading of rail has been discussed under C-1.

The resourcefulness and capability of a roadmaster are demonstrated in his handling of the distribution, laying and picking up of rail and fittings on sizeable renewal jobs. The prevention of accidents depends on his ability to organize for the most efficient procedure. He should be in personal charge of the organization and operation of the work train distributing material until the maximum efficiency is secured, and should thereafter frequently check its operation. The prevention of rough handling of the train, taking full advantage of every opportunity to work but avoiding unnecessary haste and confusion, is largely up to him.

It is generally most economical and safest to distribute fittings as close as possible to the actual point of use direct from the cars, thereby avoiding trucking. Joints, tie plates and rail anchors may be dropped directly opposite each panel of track, leaving only spikes, bolts, nut locks and tie plugs for push-car distribution from kegs or bundles left at proper intervals. All material should be strung out at one operation of the train. If joints, plates or anchors are in box cars, one man in the door should drop them while others keep a supply in the door. Two droppers are necessary for plates, which must be in uniform bunches of five by count. If these articles are in gondola cars with no ledge along the top, each man in the car must drop his own quota per panel, requiring more care for accuracy. Flat cars afford the easiest distribution.

The safety features to be watched are to avoid pressing men too closely to get material out, and to space them apart and keep them from bumping into each other or stumbling and dropping material on their feet, also to avoid undercutting bulk piles and having the top of the pile shaken down on the men.

Drop articles carefully to the ground to minimize bouncing—don't toss them. A man or men must follow close behind the train to remove pieces too close to the rail. If the material is being dropped toward the adjacent main track, he must be at hand to clear the rail instantly before a train passes, but must stay far enough to the side to avoid being struck by a bouncing piece. Of course, the work train must be stopped in ample time for the passage of a train on the adjacent track.

Kegs of spikes and bolts are apt to burst or roll if dropped unaided. For a man on the ground to assist in letting them down by hand has frequently caused injured hands and mashed toes. A set of four-inch pulley blocks, with half-inch rope, suspended from the top of the car door or a gin pole in a gondola car, is better and safer at a speed of two or three miles per hour. A pair of hooks like timber-carrying hooks or luggers, attached to this light block and fall arrangement, permits a keg to be lowered quickly and safely to a man on the ground who releases the grab hook.

Keeping the speed of the train to any easy gait, keeping those on the ground clear of falling material, and keeping material from fouling the tracks, are all duties of the man in charge, who should himself walk at the side of the train all of the time that distribution is going on.

D-2. Laying Track and Switches

An important safety feature is to have a capable foreman, assistant or gang leader in charge of each group engaged in the renewal work. These groups are:

(1) Gang doing detail distributing of material ahead.
(2) Spike pulling group.
(3) Throw-out men, throwing out the string of old rail, tie plates, etc.

(4) Adzers and plate setter.
(5) Tongmen, bolters and spikers.
(6) Back spikers and anchorers.
(7) Breaking up old rail and piling material.

The use of a self-propelling power hoist for setting rails into track, replacing the tongmen, greatly reduces the hazard of injury, as well as expedites the work of the gang.

Injuries occur more frequently in group five; groups two and three coming next. Some details of safety to be watched are: Separating paired rails to avoid turning one over on feet when the other is lifted; keeping all tools and material out of the way of tongmen; keeping all other men out of the way of the rail being carried. The tong-boss should be at the rear where he can see the movements of all tongmen and he should call all signals to lift, lower, slide, etc.

Each pair of clawbar men should be spaced a half rail from those on either side. Adzers should be spaced four ties apart. All men passing by adzers or clawbar men should walk outside the rail on the opposite side of the track from them.

In laying switches, stock rails should be kinked and drilled and points hung in advance, with the point wired to the stock rail at the top to facilitate safe handling. Guard rails should likewise be drilled and hung in advance by accurate measurement, and lead rails paired and drilled. A section gang or detachment should do this advance work and should then do the lining of the turnout, the full spiking of the switch plates, frog, etc., permitting the steel laying gang to continue without bunching up and becoming disorganized, which always increases the hazard of accident.

Moving a heavy spring frog by hand is the most dangerous job in laying switches and requires utmost watchfulness to keep from contact with attached plates. Every movement should be called by the foreman who must see that all are in the clear for it.

It is essential for the safety as well as the efficiency of a large steel gang that an ample supply of good tools be maintained. For a 100-man gang a tool man will be kept busy grinding adzes, drill bits and chisels, putting handles in mauls, dressing the burrs off the backs of claw bars, etc. The roadmaster must frequently inspect the tools in the field and the reserve supply in the tool car, no matter how careful he thinks the foreman is about this.

The more expensive heat-treated and alloy steel tools are safer and more economical, but require expert treatment in repair, with fine, closely regulated furnaces for tempering and heat-treating.

The handling of tools is discussed in section "S."

The modern practice of cutting bolts on released rail by the oxy-acetylene torch has practically eliminated the hazardous breaking off or chisel cutting of them. If a pair of cylinders, hose and torch are kept on a push car ahead of the throwout gang, cuts for crossings, bridges, etc., may be made quickly without need for chisel work. It is, however, usually quicker and safer to cut the old rail in track with a chisel for a temporary connection, than with a torch, avoiding burns from the hot rail end while making a joint.

Careful planning of all details and constant supervision are the best safeguards in laying track and switches.

D-3. Picking Up Released and Surplus Material

Time will be saved and safety increased by placing the bars, tie plates, anchors, spikes and bolts from each panel of track in small lots at the side of the track, clear of the released rail, and loading them into cars on the same work train that loads the rail. A few men can pick up and load this material if it is in small quantities, as fast as the rail is loaded and avoid haste and confusion. There should be one car for new material, one for joints and anchors, one for tie plates and one for scrap spikes and bolts. The placing of one or two men in each car to throw back or pile and count the material as handled, keep the work orderly and safe.

The rail should be piled in even tiers in the car, either all workwise or balled in as desired. This takes a little more time and care in loading, but saves time and hazard in unloading.

Whether the smaller material is picked up at the same time as the rail or not, it is safer and usually easier to gather up the small piles along each panel of track and toss them on slowly moving cars, with men walking beside the train, than to take the time to bunch it in large piles and then stop the train and have men get in each other's way, trying to work around the pile.

E-1. Distributing Material for Track Construction

This item is largely covered by D-1. One of the common difficulties resulting in unnecessary accidents, results from shipping material to the job before it can be properly placed, and the necessity for releasing cars makes it necessary to unload where it is in the way, and re-handle it on the ground two or three times. The roadmaster can often correct this to a considerable extent by arranging in advance for the co-operation of the store department and others, in shipping only at his request but promptly, the items in the order required. This will often enable him to construct some tracks and switches for use in distributing the balance of the material for the job to great advantage, reducing costs and accidents. On very large jobs a thoughtfully arranged local material yard will enable him to control this.

New construction often calls for the employment of large numbers of inexperienced men. It is of advantage in many circumstances to take some experienced gangs or groups from the regular force and put them on the more hazardous new work, placing some of the inexperienced men on maintenance work of less hazard, or mix them with seasoned men.

E-2. Laying Track and Switches

There are but few points not already mentioned under D-2.

The hazards to be met in greater degree than in renewal work are: (1) More handling of material by hand, (2) Walking over skeleton track more of the time.

Only by closer supervision and more deliberate movement can one improve safety either in the excessive handling of ties, rails, etc., or in walking about skeleton track. Keeping the space clear along the ends of ties laid out for a track will provide aisles or walkways with a minimum chance of tripping and falling.

F. Ballast Work

The roadmaster should see that a slow order is provided where warranted, both to protect impaired track and decrease the danger of men being hit. He should ride engines of various classes of trains to observe the way his gangs watch for approaching trains and clear the track. He cannot be too critical of this for it is of first importance in all kinds of track work. He should also make vigorous complaint of any failure of enginemen to observe slow orders or failure to whistle warnings to gangs on the track.

F-1. Cleaning Old Ballast

Where screens are erected that foul the track or where trucking cars are used, ample flag protection

must, of course, be afforded. Where the McWilliams ballast mole or similar power-operated equipment is used, the power must be shut off promptly and the men given time to clear the track. The noise of power equipment sometimes prevents men from hearing a warning and all of the men should be taught to look about quickly when warned off the track to see that none has failed to get the warning.

Keeping men spaced apart from each other to avoid striking one another is a matter to be watched continually. Men must be thoroughly taught to keep hands and feet from moving parts of machinery. Carrying boxes and baskets must be kept in good condition to avoid causing the men to stumble and trip while using them.

F-2. Unloading and Spreading Ballast

The men accompanying a ballast or other work train should be provided with a coach or similar car in which to ride at all times except while their work is actually in progress. The roadmaster and foreman must insist on all men riding in this coach, and should not tolerate their riding out on other cars.

It should be impressed on trainmen that when the work starts, no signals are to be given for movements except by the foreman or a man designated by him except stop signals in emergency, also that the safety of all of the men engaged in the work, depends on the careful handling of the train by the engineman and his alertness in observing and following signals, which must be given with judgment.

On double track, one trainman should be designated as a lookout for trains approaching on the adjacent track and the engineman of the work train should also whistle an alarm when such a train is seen. Work must then be stopped till the train passes.

The roadmaster should be in personal charge of ballast unloading, at least until he is sure that the men are properly lined up and fully understand their work. He should visit the work thereafter as frequently as possible, watching out particularly for the following safety features:

(a) Men must not be allowed to go into a car to assist in working the ballast down until the entire top of the load has caved in and they must then be allowed to go only in cars where center beam and cross braces give them security from falling through into the hopper bottom. Only active experienced men should be allowed to work on a ballast train.

(b) Men must not be allowed to climb across moving cars, but may at the foreman's discretion, be allowed to drop off a slowly moving car and get on another. They must look carefully before dropping tools off or throwing them onto the platform of a car, to avoid striking others.

(c) Levers and ratchets of old Hart and Rogers type cars should be operated by short pipe extension sleeves and round-peaned hammers to save finger and knuckle injuries from bent or worn parts.

(d) If the ballast is wet or does not run freely, the car may be shaken up or jarred by the use of a coal pick or track punch, stuck under a wheel at an angle, allowing the wheel to drop off of it at about the middle or handle-eye. The tool must be thin enough to avoid raising the wheel flange to the top of the rail. The men on the car must be warned before the car is shaken, and be known to be in a secure position. This shaking often makes it unnecessary for men to get into a car at all.

(e) It is better to have two or three hoppers partly open with a moderate flow of gravel and the train moving slowly so that men can work with assurance and avoid the necessity for stopping and starting or increasing and decreasing speed. The less the disturbance of train, the greater will be the safety of all at work.

(f) If plowing of the ballast with ties placed ahead of the wheels is absolutely unavoidable, men must keep their hands and feet off the ends of ties, using shovels to hold the ties in place if necessary, and should walk at the side or ride at the sill step but should not get up on the end of a car so used.

G. Care and Manipulation of Tools

(See also report of Committee on Non-Train Accidents, Safety Section A. R. A. Section F.)

G-1. Track Jacks

Unsafe methods to be continually watched for and corrected:

Using a jack with badly worn teeth, pawls, trunnions or lifting foot.

Leaving the lever in a jack after the operation of it is stopped.

Using one jack where more are needed, resulting in three or four men on one lever.

Using a sharp end bar in a socket with an open inner end.

"Pumping" a jack too fast to insure the full engagement of the pawls.

Working with one's head or body over the top or end of a lever so as to be struck if the lever flies up.

Hurrying to the next spot and sliding the jack ahead on the rail has caused many falls and mashed toes. Go slow.

Tripping the jack to drop the load without calling and looking to see that all of the men are in the clear.

Using a jack inside of the rail without flag protection.

Trying to lift with the jack tilted.

G-2. Claw Bars

To prevent mashing fingers on the opposite rail, get bars with a long-raked heel that will lift a spike two-thirds of the way out without coming near the opposite rail. Then turn the bar up nearly straight and jerk it upward on the spike to pull it the rest of the way. Demonstrate the proper use of the claw bar to every inexperienced man the first thing when he joins the gang.

A ring, like a washer, of ⅜ in. or ½ in. material and 1 in. deep, can be slipped over the end of the bar and welded at the point where it strikes the opposite rail to serve as a stop block.

Unsafe methods to be watched for and corrected:

Failure to use the shank of a maul for a fulcrum under the heel of the bar when needed.

Using a bar with a battered heel. It should be dressed on a grinder daily if necessary.

Using a bar with a rounded chisel end for nipping up rail. Keep the end flat and sharp.

An inadequate supply of bars to prevent damaged bars from being replaced promptly, or unskillful workmanship at the track tool repair plant.

G-3. Mauls and Sledges

Unsafe methods to be watched for and corrected:

Failure to inspect the tools daily for cracks around the edge of the striking face and discarding such tools when any cracks appear.

Using a maul or sledge that is worn down on one side of the face.

Using a tool with a handle cracked or broken or not securely wedged.

Striking a chisel, punch, flatter, rail, stone or concrete without protecting with goggles the eyes of those engaged and getting other men away.

Failing to start a spike well into a tie before striking it a full blow.

Allowing men to work too closely together where such tools are being used.

G-4. Cutting Chisels and Punches

Unsafe methods to be watched for and corrected:

Using a cutting chisel without goggles on the eyes of the holder and the striker while others turn their heads away.

Using any such tool with a cracked or mushroomed head, or a chisel with a flaked or crumbled edge.

Using a maul instead of a sledge to strike a cutting chisel.

Failure to keep tools dressed on the grinder, with which each gang should be equipped.

G-5. Wrenches

Unsafe methods to be watched for and corrected:

Using a wrench of improper size or one with jaws spread, worn or cracked.

Standing astride a rail when pulling on a wrench or failure to keep braced against a possible fall.

Not watching to see that the full width and depth of the wrench is on the nut before exerting a pull.

Trying to close spread jaws by hammering them. They should be repaired only by expert workmen at a tool shop.

G-6. Lining and Prying Bars

Unsafe practices:

Dropping bars without looking to see if any one is near.

Trying to line rail with a bar too nearly vertical, resulting in the end tearing out.

Straddling the bar when lining track.

Nipping rail up with a blunt end bar.

Straddling a bar when holding up the tie.

Prying without a firm purchase and solid fulcrum.

Using a lining bar to turn rail over has caused many serious injuries. Use a rail fork or short buggy bar.

G-7. Picks

Unsafe methods to be watched for and corrected:

Using dull picks has probably been the chief cause of accidents involving this tool, such as falling when dragging ties, getting particles in eyes, glancing blows striking feet, etc. It is essential that the supply of picks be ample and that repairs be made promptly by an expert smith.

Using a pick in freshly creosoted ties, as it slips too easily.

Men working too close together, a man struck by a swinging pick is almost sure to be badly hurt. A man using a pick should always glance back of him before starting to use it. Others should never pass close to a man so engaged.

Leaving picks sticking up in the ground; they should always be laid flat.

G-8. Shovels

Unsafe methods to be watched for and corrected:

Using shovels with cracked, splintered or rough handles or loose rivets.

Using shovels to spear and drag ties.

Using shovels to pry nails loose in cars or piles.

Using shovels with men too close together.

Laying shovels down with their edges up. They should be piled or stuck up at the roadside when not in use.

When sharpened with a file, one should stroke away from the handle. Many bad cuts have resulted from sticking the handle under a rail and filing toward it. One man should hold the shovel over the edge of a rail or tie while the other files.

G-9. Adzes and Axes

Unsafe methods to be watched for and corrected:

Using tools without having them tightly wedged on the handle.

Standing on a piece of timber while dressing or splitting it.

Starting to use an adze or axe without insuring that no one is near enough to be struck.

Laying a tool down where it can be stumbled over or kicked.

G-10. Scythes

Unsafe methods to be watched for and corrected:

Hauling them on cars with the blades attached.

Swinging them when within ten feet of other persons.

Laying them down where they can be stumbled over or kicked against.

Piling blades with other tools, instead of bundling them in burlap.

Standing them up where they can fall if disturbed.

H. General

We believe that the detection and correction of unsafe methods and practices is more a matter of arousing foremen and supervisors to keener observation, than of teaching them how to distinguish between safe and unsafe methods.

Most experienced men can actually tell what is the safest procedure in any detail of work, for much has been said and written about that in recent years. Yet unsafe practices and rule violations are occurring almost under their noses every day, but pass unchallenged because they are unnoticed. Even sincerely interested officers sometimes violate their own rules without noticing it or thinking of it.

We believe that it will help any officer to improve his powers of observation if he will, at least once a month and oftener if possible, devote a day or two to a trip by motor car or auto for the sole purpose of watching his men and their performance, from a safety standpoint only. Sitting down where one can watch a gang for an hour, telling the foreman to keep right on with his work and seeing how many little criticisms one can jot down, will prove interesting. It will prove more interesting if done unaware with a good pair of field glasses. After a day or two of this, select the more important items from the notes, visit each gang, stop work for a short safety meeting and tell the men kindly just what was observed in that and other gangs, and how you wish correction to be made.

A few safety trips of this kind will create a greater interest, a keener power of perception and more safety consciousness and respect for rules than many so-called rallies. It will also pave the way for disciplinary action where that becomes necessary, but will greatly decrease the need of it.

Committee—G. H. Warfel, chairman, assistant to general manager, U. P.; K. M. Hammon, vice-chairman, assistant engineer maintenance of way, Long Island; M. M. Barrett, supervisor, N. Y. N. H. & H.; W. E. Carter, supervisor, B. & L. E.; W. P. Clear, supervisor, C. G. W.; J. P. Corcoran, roadmaster, C. & A.; W. A. Enderle, roadmaster, S. P.; J. L. Galavin, general roadmaster, U. P.; J. J. Gallagher, roadmaster, M-K-T; A. E. McCullough, supervisor, C. C. C. & St. L.; E. P. Safford, supervisor, N. Y. C.; J. Shea, roadmaster, D. & I. R.; O. Supernant, roadmaster, D. & H.; and D. Vallier, supervisor, B. & M.

Discussion

P. J. McAndrews (C. & N. W.) inquired as to the section of the report objecting to the practice of spiking across the rail and with respect to this C. T. Kimbrough (I. H. B.) stated that that practice was prohibited on his road, as a number of accidents had resulted from it. Mr. McAndrews said that he had made a number of surprse checks of his foremen but that they were the result of chance rather than a definite intention on his part. It is his experience that it is good practice to time section motor cars when riding on them as he has found that most foremen underestimate the speed at which their cars are traveling.

Considerable discussion centered on the portion of the report advocating that foremen be required to observe trains carrying signals for following sections but it was the consensus of those who spoke on this subject that operating rules should be revised so as to require enginemen to sound whistle signals and that section foremen should be expected to acknowledge such signals.

T. F. Donahoe (B. & O.) described the practices of the B. & O. in giving lineups to the operators of motor cars. Operators are required to give such lineups on the printed form which the foremen must sign and in the case of heavy cars an entry is made on the train sheet, the foremen being required to report when his car is in the clear after such an entry has been made. All cars are provided with portable telephones so that the operators may obtain lineups when away from stations.

W. O. Frame (C. B. & Q.) objected to the requirement of the report prohibiting the unloading of ties through trap doors of gondola cars. This view was

endorsed by Mr. McAndrews who contended that there was less hazard in unloading ties in this way than to lift them over the top, and on a motion of J. B. Kelly (M. St. P. & S. S. M.) the sentence in the report covering this detail was withdrawn.

In discussing practice in the cutting of rails Mr. Donahoe reported that he has had great success with the use of hack saws in place of track chisels, stating that a 130-lb. rail can be cut readily in three or four minutes. A cut is made in the edge of one flange from one-quarter to one-half inch deep after which the rail is broken by bending in the usual manner.

Weed Control and Elimination

REPORT OF COMMITTEE

A. Chinn
Chairman

THE PROBLEM of controlling and eliminating weeds and other vegetation that grow in the track and right-of-way has faced the railroads since they were first built. Weeds make track appear unsightly and poorly maintained and are the greatest factor in causing dirt to collect in the ballast. This dirt soon fills the voids of the ballast, promotes further growth of vegetation and causes the ballast to hold water and puddle, thereby depriving it of the very characteristic for which it was installed, namely, to provide drainage and support for the track structure. The moisture that it holds under these conditions attacks the ties and hastens decay, with resulting loss of service life.

Aside from the loss in ballast and ties, there is also damage to rail and other metallic track parts, by reason of improperly supported track, which means additional loss. Track that is improperly supported will never ride well and as a consequence a larger maintenance force will usually be worked than would otherwise be the case. Another consideration in keeping down weeds that is gaining in importance every year is appearance. Good appearance has a two-fold beneficial effect, that on the traveling public which is inclined to favor a neat, well kept road, and that on the employees who take more interest and pride in their work and will exert greater effort to keep their track maintained as well as it looks.

Many Methods in Use

Many methods of eradicating weeds in track have been tried and are in use, there having been a rapid change from the old and costly methods of hand pulling and scuffle hoes to the present general practice of burning and chemical destruction with a minimum of hand labor and a noticeable reduction in costs. Increase in the cost of hand labor and the necessity for faster and more effective work have brought these changes about.

It is generally conceded that one of the best ways to keep weeds out of the track is to have a good grade of clean ballast. However, dirt starts to collect in ballast as soon as it is installed and weeds will commence growing in it long before it is ready for replacement. This committee is chiefly concerned with methods of preventing weed growth in track so that the full life of the ballast may be realized and the track maintained neatly and economically.

Hand Methods

Hand methods are still in use in restricted localities where traffic or other conditions make it inadvisable to use the more rapid and modern means. Also considerable hand labor is used at different times to follow up burning or chemical destruction, to produce a grass line that will be in keeping with the appearance of the balance of the roadway. However, the use of hand labor is becoming less general as mechanical and chemical means are introduced that will accomplish better results at less cost. Hand labor will probably never be entirely eliminated but it will be confined to the cleaning and mowing of those parts of the right-of-way that are too irregular to be taken care of by other methods. Where it is necessary to use hand methods, it is found economical to furnish the best tools available so that the work can be carried on rapidly and with as little delay as possible from defective or inefficient tools.

A review of hand weeding on several railroads shows that it costs from $30 to $90 per mile for one weeding and this work will keep the vegetation down only three to eight weeks, depending largely on climatic conditions. To keep the track clean for the entire season will cost from $90 to $250 per mile for the several weedings required. Hand weeding is not favored because of the high cost and the temporary results obtained. Also roadmasters who have used this method feel that the removal of weeds and other growths from the ballast by hand picking and hoeing disturbs the ballast and leads to about the same results as the reworking of a seed bed which stimulates the return of new growth very quickly.

Cost of Eliminating Weeds in Ballast Section by Hand

Road	Territory	Width of Section Weeded	Cost of Mile	Remarks
A	Wisconsin	15 ft.	$60.00	
A	Iowa	15 ft.	36.00	Average growth
B	Utah	15 ft.	60.00	Heavy growth
B	Utah	15 ft.	30.00	Normal growth
C	Florida	14 ft.	90.00	Heavy growth
C	Florida	14 ft.	68.00	Normal growth
D	Virginia	19 ft.	49.60	
E	Minnesota	16 ft.	18.00	Light growth
E	Minnesota	16 ft.	54.00	Heavy growth
F	Texas	16 ft.	35.00	Medium growth

Figures are for one time over. Will take several weedings per season to keep track clean.

The old practice of mowing one or two swaths outside of the ballast line with scythes is now being discarded in favor of gasoline-driven track mowers. There are several types of these machines on the market that do excellent work at a cost of about one-fourth that of hand labor. Some of the earlier types of track mowers were equipped with a mow-

ing arm on only one side so that on single track it was necessary to cover the line twice to mow one swath on each side and four times if a second swath was wanted. Later machines are equipped with sickles on both side so that one trip will do the work of two of the old type. Reports show that it costs from $4 to $6.50 per mile for each single swath mowed by hand with a scythe while a single sickle track mower will do the same work for $0.70 to $1.80 a mile and a double sickle mower for $0.40 to $0.90. Track mowers require a motor car to pull them and a force of three to five men to operate the outfit and cover from 10 to 15 miles per day for each extension of the sickle, depending on traffic and other local conditions. A very flexible machine is now on the market that is so constructed that the sickle arms can be quickly adjusted to mow at any desired distance from the track up to a maximum of about 20 ft. and at the same time can be raised or lowered to fit the varying angles of the slopes of cuts and fills. A machine of this type not only does much cheaper work than can be done by hand, but also gives a finished job that is much neater and more uniform.

Along with the introduction of track mowers, most roads have found that the mowing of the right-of-way, outside of the track section, can be done where the contour of the ground permits, much cheaper with horse-drawn farm mowers than with scythes. Figures furnished by several roads show that it costs from $33 to $52 per mile to cut weeds by hand outside of the track section on the ordinary 100-ft. right-of-way, while team-drawn mowers cost only $11 to $36 per mile. Mowing the right-of-way has the advantages of keeping the roadway looking neat and of assisting in preventing the spread of weeds to the track. Right-of-way that is mowed regularly, particularly in central western territory, will soon grow a good grade of grass that the adjoining land owners are usually glad to cut for the privilege of obtaining the hay. In this way a neat right-of-way can be maintained at practically no cost to the railroad.

Cost of Hand Mowing (Scythe)

Road	Territory	Width of Right of Way Mowed	Cost per Mile	Remarks
A	Iowa	1 swath on shoulder	$ 6.50	
A	Iowa	Fence to fence	52.00	
A	Iowa	Fence to fence	36.00	
G	Wisconsin	2 swaths on both sides and 200 ft. road crossings	19.96	Rough right-of-way, heavy growth
G	Illinois	2 swaths on both sides and 200 ft. road crossings	19.80	Heavy growth
G	Illinois	Fence to fence	40.60	Double track, 100 ft. right-of-way. Light growth, smooth right-of-way
G	Illinois	Fence to fence	56.70	Single track, 100 ft. right-of-way. Medium growth, fairly smooth
E	Minnesota	Two 6-ft swaths outside ballast lines	10.50	
E	Minnesota	Fence to fence 72 ft. outside ballast section	33.00	Cut all brush and weeds

Mechanical Devices

Machines that disc the ballast from the ends of the ties to the toe of the ballast have been used with considerable success on several roads. Discing will temporarily destroy the weeds in that part of the ballast section where they grow heaviest and in that way will reduce the area to be hand weeded to the section between the ends of the ties. The roads using discing machines report that they make a saving of approximately 50 per cent as compared with the use of hand labor for the entire ballast section. Another advantage claimed for the discing is that it tends to open up the ballast at the ends of the ties, by giving freer drainage. As a rule, discers are confined to the lines that have sand, cinder or gravel ballast as it is felt that they mix too much dirt with superior ballasts such as slag or stone. Discers of light construction that can easily be removed from the track by the men that are using them and which do not require a train crew to operate are the most desirable, as their cost of operation is the least. The

Cost of Ballast Discing

Road	Territory	Miles per Day	Cost per Mile	Remarks
A	Wisconsin		$ 4.00	Both sides of track
A	Iowa	2	10.00	Both sides of track, gravel and cinder ballast
E	Minnesota		1.50	Costs $8.50 per mile additional to clean out center track with scuffle hoes
A	Wisconsin		1.50	Both sides of track

Crew: 1 operator, 2 section men handling discs, 2 section men flagging.
Costs are for one time over.

Cost of Team Mowing

Road	Territory	Width of Right of Way Mowed	Cost per Mile	Remarks
A	Iowa	Fence to fence	$16.00	One-third the cost of hand mowing
G	Wisconsin	One and two sides to right-of-way fence	22.11	Double track, heavy growth, rough right-of-way
G	Illinois	Fence to fence	11.81	Double track, smooth right-of-way, grass growth
G	Illinois	Fence to fence	26.30	Single track, medium smooth right-of-way, growth fairly heavy
G	Wyoming	Fence to fence	11.00	Single track main line, level right-of-way, grass growth
F	Texas	Fence to fence	15.00	

Cost of Gasoline-Driven Weed Mower (1 Side Mowing)

Road	Territory	Width of Swath Cut	Track Miles Mowed per Day	Cost per Track Mile, 1 Swath, 1 Side	Remarks
G	Wisconsin	7 ft.	14.5	$0.71	Mowed 1 swath at time, on account of double track, 4 men
G	Illinois	7 ft.	13.0	1.11	Mowed 1 swath at time, on account of double track
G	Illinois	7 ft.	6.7	1.09	Single track, heavy mowing, 3 men
G	Illinois	7 ft.	9.7	1.20	Single-track branch line, 4 men, delays for repairs
G	Illinois	7 ft.	10.5	1.28	Main line, 5 men, single track
G	Illinois	7 ft.	12.8	0.89	Single-track main line, 3 men
G	Nebraska	7 ft.		0.91	Maine line, 3 men
G	Nebraska	7 ft.		0.90	
E	Minnesota	6 ft.		1.86	Gear driven motor
Okla.	Oklahoma			1.51	

Costs shown are for one time over.

Cost of Gasoline Driven Track Mower (2-Side Mowing)

Road	Territory	Width of Swath Cut	Track Miles Mowed per Day	Cost per Track Mile, 2 Swaths, 1 Each Side	Remarks
G	Illinois	7 ft. ea. side	12.0	$0.83	Light growth, single track branch line, 3 men
G	Illinois	7 ft. ea. side	8.4	1.60	Branch line, single track, 3 men, heavy repair cost
G	Illinois	7 ft. ea. side	10.8	1.31	Branch line, single track, 3 men
G	Illinois	7 ft. ea. side	9.0	1.61	Main line, single track, 4 men
G	Illinois	7 ft. ea. side	12.5	1.07	Branch line, single track, 3 men
G	Illinois	7 ft. ea. side	9.9	1.29	Branch line, single track, 4 men
G	Wyoming	7 ft. ea. side		1.70	Main line, heavy cutting
G	Nebraska	7 ft. ea. side		1.52	
G	Nebraska	7 ft. ea. side		0.62	Special type mower
A	S. Dakota	6 ft. ea. side		1.30	Field mower on push car
E	Minnesota	6 ft. ea. side		1.68	Power driven sickles
F	Oklahoma			1.81	Main line, heavy cutting

Costs shown are for one time over.

cost of operating discers seems to vary greatly, depending on the size of the discer, the class of ballast, method of operation and traffic conditions. Reports received by the committee show these costs to vary from $1.50 to $10 per mile for discing on both sides and that machines will cover from two to eight miles per day.

Another mechanical device, known as a "weed whipper," is used on the branch lines of some roads where it is not desired to control the weeds except to an extent that will prevent an actual tie-up of traffic. This is a device that is attached to the tender of a locomotive and is driven in a whirling movement by a pulley and belt on the axle of the tender, the whirling movement being in the direction opposite to the movement of the tender wheels. It will cut the vegetation down to about the top of rail over a width of eight feet. It does not clean the weeds out of the track but keeps them down so that they will not get over the rail and interfere with train movements. One device will take care of 100 miles of track and will cost about $50 to operate for a season.

Burning and Steaming

In an effort to reduce the costs of hand methods, locomotive-propelled weed burners and weed steamers were introduced. The locomotive-propelled weed burner consists of a burner hood and flame pots mounted on one end of a flat car that is also equipped with an oil pump for drawing the fuel oil from a tank car, an oil pressure equalizing tank and valves for controlling the flow of oil and regulating the steam. The first machines of this type used compressed air for atomizing the oil but later it was found that this could be done much better and more cheaply by using steam direct from the locomotive. The burner pots and hoods are arranged so that a total width of from 15 to 17 ft. will be covered by the flame. Machines of this type operate at a speed of from 8 to 12 miles per hour and cover from 45 to 65 miles per day. They consume from 45 to 90 gal. of crude oil per mile and the cost of operation varies from $3.00 to $6.75 per mile for one burning, depending on the size of the burner and the growth of weeds. The first burning usually scorches and dries up the weeds only, so that it is necessary to follow in a few days with a second burning to consume the dried weeds and give clean track. Burning consumes the tops of the vegetation but does not kill the roots and regrowth starts immediately. Consequently, if clean track is wanted, it is necessary to

Cost of Locomotive-Propelled Weed Burner

Road	Territory	Width Burned	Gallons Oil Used per Mile	Miles Burned per Day	Total Cost per Mile	Remarks
A	Wisconsin				$6.00	
G	Illinois	15 ft.	78.8	66.5	5.27	One burning
G	Iowa	15 ft.	93.0	50.0	4.42	One burning
G	Missouri	15 ft.	46.0	60.0	2.73	One burning
G	Nebraska	15 ft.	57.0	45.3	5.87	One burning
D	Virginia	17 ft.			6.85	Average for 2 burnings
G	Nebraska	15 ft.	80.0	50.0	4.76	One burning

Costs shown are for single burning.
Burner must go over line twice for each complete burning.
Several complete burnings required per season.

Cost of Locomotive-Propelled Weed Steamer (Scalder)

Road	Territory	Width Scalded	Miles Scalded per Day	Total Cost per Mile	Remarks
A	Iowa	9 ft.	8	$ 9.80	Run in June; weeds heavy
A	Iowa	8 ft.	17	4.86	Weeds not large
A	S. Dakota			4.25	
D	Virginia	14 ft.		12.85	
A	Wyoming	8 ft.		3.72	

Costs shown are for one steaming.
Several steamings required per season.

have two or three double burnings a season at a total cost ranging from $12 to $14 per mile. One of the chief objections to a burner of this kind is that some roads feel that there is danger of damaging the ties. To overcome this objection some burners are equipped with a sprinkling device that trails the flame and assists in putting out any fires that may start in the track. A sprinkler necessitates the use of one or more tank cars in the outfit and it has not been definitely shown that its use is economical.

Weed steamers or scalders were introduced about the same time as weed burners. They consist of a steamer frame about 8 ft. wide by 10 ft. long, mounted underneath a flat car and supplied with steam from the locomotive that handles the outfit. The steamer frame is surrounded with a canvas flap that holds the steam on the weeds. The best results are obtained when superheated steam is used. The steamer is much slower than the burner, covering only 10 to 18 miles per day but as there is no danger from fire it can be used in localities where the burner is not adaptable. So far as killing the tops of the weeds is concerned, it is about as efficient as the burner, the disadvantage being that the dead weeds are not consumed and if clean track is to be had considerable hand labor is required to follow up and clean out the dead stalks. Steaming is not generally favored as it leaves a ragged looking job, requiring too much hand labor to clean up. The cost ranges from $3.75 to $12.85 a mile for one time over depending on the size of the steamer, the width covered and the speed of operation. As with a flame burner, the roots of the weeds are not killed and two or three trips a season are required to keep the vegetation down, which makes the cost for the season run from $7.50 to $38.50 per mile.

To reduce the cost of burning further by the elimination of work train expenses, several companies have put on the market small gasoline-driven weed burners. These machines are self-propelled and carry their own supply of oil for the burners, either in a small tank car which is part of the outfit, or in a supply tank mounted on the outfit itself. The first machines introduced had burner hoods of fixed dimensions which limited the width that could be burned. These widths varied from 8 to 15 ft. according to the type of machine. Later improved machines with movable pipe burners were brought out that will burn an initial width of 12 to 20 ft. and as much wider as desired on second trips up to 35 ft. The oil for the burners is atomized by a high speed blower run by the engine that propels the outfit, and a high pressure oil pump which delivers the required quantity of oil to the blower atomizer. The mixture of oil and air can be adjusted to give a white hot flame at the burner hood or pipes without generating smoke or soot. A crew of two or three men is required to operate one of these machines and a conductor is usually assigned to protect against train movements. The comparatively small investment involved, together with the small force required for operation, keeps the cost down to about 70 per cent of that of a locomotive-propelled burner. A high grade of fuel oil or distillate is used instead of the low grade heavy fuel oil burned by the locomotive-propelled machines, but considerably less oil is used per mile, which makes the final cost of the oil somewhat lower. A check on the performance of these machines shows that they will cover from 15 to 25 miles of track per day, burning from 15 to 38 gal. of fuel oil per mile and costing from $2.50 to $4.50 per mile of single burning, depending on the kind of machine used and the weed growth being burned. Owing to their flexibility, ease of handling and economy of operation, it is felt that this type of machine is the best for any territory where burning is considered the desirable method of weed control. As far as fire hazards and the return of weed growth are concerned, they have the same disadvantages as the large locomotive-propelled burners, but the fact that they accomplish the same or better results at a lower cost makes them the preferred machine for burning weeds in the track section.

Cost of Gasoline-Driven Weed Burner

Road	Territory	Width Burned	Gallons Oil per Mile	Miles per Day	Total Cost per Mile	Remarks
A	Illinois	9 ft.	13	15	$3.00	Shoulder only on main track
A	Iowa	9 ft.	14.5	24	2.06	One burning
A	Iowa	9 ft.			2.40	One burning
G	Illinois	8 ft.	25.4	18.9	3.12	One burning
G	Iowa	8 ft.	38.5	13.7	3.58	One burning
G	Missouri	8 ft.	34.8	13.2	3.92	One burning
G	Nebraska	8 ft.	20.3	24.7	1.61	Light burning
F	So. Texas	16 ft.			4.50	Average for two burnings
E	Minnesota	8 ft.			6.21	Repair costs high

Costs shown are for single burning.
Burner must go over line twice for each complete burning.
Several complete burnings required per season.

Chemical Weeding

The more recent method of weed eradication is by chemical poisoning and suffocation. This method is gaining steadily in popularity as it gives the most rapid, economical and lasting results with the least interruption to other maintenance activities. While the initial cost of applying the chemical is higher than any method other than hand labor, the fact that one application is usually sufficient for an entire season brings the final cost per mile for the year below that of any other method that will produce track as reasonably clean as chemical treatment. It should not be overlooked also that chemical has a cumulative effect in retarding weed growth in following years. This effect is such that less chemical is required for second, third and succeeding treatments and the result is that the cost of chemical application is gradually reduced until it is only a fraction of the cost of other methods.

Two kinds of chemical are being used. One is a poisonous compound, made up of arsenic trioxide containing 4 lb. of chemically pure arsenic and 1 to 1¼ lb. of caustic soda, dissolved in a gallon of water in the concentrated solution. The other is non-poisonous and is made according to trade for-

mulas that are not generally known. The effective agent of the non-poisonous chemical is sodium chlorate, of which 3½ to 4½ lb. is contained per gallon of concentrated chemical.

The action of the two chemicals on the weeds is considerably different. The poisonous compound kills through the distribution of a toxic solution carried through the plant by the sap circulation. The killing agent of the non-poisonous solution is nascent oxygen which is released from the chlorate salt. This nascent oxygen oxidizes the organic matter of the plant, which in turn causes suffocation.

Yearly Record of Chemical Application

Railroad	Year	Total Single Track Miles Treated	Total Gallons	Average Gallons per Mile
A	1925	1086.5	76,296	70.2
	1926	1679.0	93,800	50.0
	1927	2178.0	117,787	54.0
	1928	3222.7	142,711	44.3
G	1925	331.0	20,000	60.0
	1926	1315.0	70,000	53.0
	1927	5056.0	259,000	51.0
	1928	5652.1	221,400	39.1
H	1925	900.0	59,950	66.5
	1926	2547.9	208,300	81.7
	1927	5063.0	395,500	78.1
	1928	5705.7	372,000	65.2

Each chemical has its particular advantages. The chief advantages of the poisonous compound are that it is cheaper, it has a certain beneficial effect on the ties, attributed to the wood preserving value of arsenic and some roads feel that the cumulative effect of the arsenic poisoning is greater than the non-poisonous. The non-poisonous compound, however, is not dangerous to live stock and is very effective on certain types of vegetation such as horsetail, Johnson grass, witch grass and quack grass that are not readily killed by the poisonous compound.

The chemical is usually applied with a work train, made up of a locomotive for propelling and furnishing the air that mixes the solution and forces it through the sprays, a series of tank cars containing the concentrated chemical and the solution being applied, and a flat car on the head end equipped with a special spray on the front for spraying the chemical on the roadbed and a meter for measuring the quantity applied. The chemical, as received, is in concentrated solution and is diluted with three to five parts of water for application. The tank cars of the application train are interconnected with a pipe line that permits the passing of the required amount of concentrated chemical from the convoy tank to any designated dilution tank of the work train, the chemical being forced through the pipe line by air pressure from the locomotive. After the proper amount of concentrated chemical is in the mixing tanks, they are placed under a water crane and filled with water. Air is then turned in at the bottom of the cars to agitate the contents and assure thorough mixture. When the solution is properly mixed the dome caps are placed, the air turned on again and pressure allowed to develop to force the solution through the sprays. The sprays consist of a series of nozzles, usually 10 to 12, arranged across the front end of the flat car to cover the ballast section and about one foot beyond on either side.

Additional nozzles may be added, if desired, to cover a greater width. The spraying nozzles have individual, quick action, control valves so that they can be shut off for any portion of the width being sprayed that does not happen to be weedy. Also a master valve is provided that controls all nozzles in case it is desired to shut off for road crossings, bridges, station grounds, etc. A later development that has materially reduced work train expense is a spray with folding extension arms on both sides, that permits spraying three tracks at one time. This is of particular advantage on double track territory or on single track where it is desired to spray passing tracks as one work train movement is sufficient. On double track territory it saves from $1.50 to $2.00 per double track mile on work train expense. Another later development is the "dual treatment." In this method both the poisonous and non-poisonous chemicals are carried in the work train with separate feed lines leading to the sprays. Two master quick-action valves allow the operator to apply either chemical at will. In this way the advantages of both chemicals can be had on one treatment, the low cost poisonous solution being sprayed on a majority of the territory and the non-poisonous through station grounds, where there is danger to live stock and on vegetation that is not readily killed by the poisonous product.

As a rule the contract with the manufacturers of the chemical provides for the chemical company furnishing the necessary tank cars for shipping the concentrated solution and for mixing tanks for the work train, also the spraying device, meter and pipes and a competent operator to handle the chemical and supervise the application. Some roads find it pos-

Cost of Chemical Application

Road	Territory	Width of R.O.W. Treated	Gallons per Mile	Miles per Day	Total Cost per Mile	Remarks
A	System	15¾ ft.	43	85	$14.25	Rock ballast, second and third applications arsenic chemical
A	System	15¾ ft.	73	85	23.50	Rock ballast, first application, gravel ballast, arsenic chemical
G	Illinois	15 ft.	28.6	74.5	10.66	Second and third applications, gravel ballast, arsenic chemical
G	Iowa	15 ft.	25.0	87.9	8.17	Second and third applications, arsenic chemical
G	Missouri	15 ft.	27.9	65.1	9.15	Slag, chatts, cinders, second and third applications, arsenic chemical
G	Wyoming	15 ft.	57.4	75.0	19.57	Single track, gravel, second application, arsenic chemical
G	Nebraska	15 ft.	34.5	59.4	11.58	Single track, second application, arsenic chemical
G	Wyoming	15 ft.	46.6	56.5	16.69	Single track, second application, arsenic chemical
C	Florida	14 ft.	95.5		41.03	Heavy growth, non-poisonous chemical
D	Virginia	14 ft.			19.73	
G	Nebraska	15 ft.	46.7	55.5	15.05	Second application, single track, arsenic chemical
F	Texas	15 ft.	71.3	34.0	32.37	Average for two districts, first application, non-poisonous chemical
F	Texas		65.8		28.31	First and second applications, non-poisonous chemical
B	Utah		50.0		15.50	Second and third applications, arsenic chemical

sible to purchase the chemical and make their own applications, thus reducing the cost of weed control.

The amount of concentrated chemical required for treatment will vary considerably according to the weed growth. On first applications the amount runs about 75 gal. per single track mile. Owing to the retarding effect on future weed growths, second applications take about 50 gal. per mile and this decreases on subsequent treatments to as low as 30 gal. A fair average to assume for third and succeeding treatments is 40 gal. per mile. The application train covers from 50 to 85 miles of track per day and operates at a speed of from 10 to 14 miles per hour. The cost varies considerably, depending on the kind of chemical being used and the weed growth. Figures gathered by the committee show that the cost of applying the non-poisonous chemical runs from $28 a mile for second applications to $41 a mile for first application on heavy growth. The poisonous product is somewhat cheaper and costs from $11 a mile for second and third applications to $23 a mile for first application where vegetation is heavy. The figures shown are for one treatment.

As a rule, one treatment is sufficient for an entire season and the effects of this treatment carry over into the following year, so that less vegetation will be in the track the next season and the costs of controlling it are correspondingly less.

While this report has dealt principally with the treatment of roadbed by work train it should be pointed out that several small devices are available for the application of chemical by hand in out-of-the-way places in yards and around buildings that cannot be reached by work train. The committee was not able to secure cost figures on hand application but it is felt that this method has its advantages and should not be overlooked when developing a weed control program.

Conclusions

The opinion of this committee is that chemical treatment offers the best method of weed control and elimination in the roadbed section. It is economical, rapid and effective. It gives cleaner track over a longer period than any other method and does not interfere with other maintenance work during application. The lasting results permit the section forces to be utilized on important track work instead of controlling weeds, which is reflected in better track conditions.

On lines where it is not practical to use chemical, the committee feels that the gasoline-driven weed burners are the best solution of the weed problem, subject always to the provision of adequate protection for the ties. These machines operate at a reasonable cost and keep the roadbed clean if operated frequently enough.

For keeping the weeds cut for the first 15 or 20 ft. outside of the track the gasoline-operated track mower is recommended as giving the best and cheapest results. For the balance of the right-of-way, horse or power drawn farm mowers should be used wherever possible. Hand labor should be confined to such locations as cannot be taken care of in any other way.

Committee: A. Chinn, chairman, engineer maintenance of way, C. B. & Q.; C. F. Allen, division engineer, C. M. St. P. & P.; W. M. Anderson, roadmaster, S. A. L.; D. B. Clark, general roadmaster, F. E. C.; J. T. Crump, cost engineer, C. & O.; M. Duberstein, chief clerk engineer maintenance, C. & N. W.; F. W. Easton, roadmaster, S. P.; B. E. Haley, general roadmaster, A. C. L.; C. M. Hayes, assistant general roadmaster, M. St. P. & S. S. M.; T. L. Hoffmeister, supervisor, Penna.; J. B. Mackenzie, district engineer, C. N. R.; W. F. Murray, division engineer, M. P.; W. C. Pruett, district engineer, M-K-T, and G. G. Smart, general supervisor of work equipment, G. N.

Discussion

J. B. Martin (N. Y. C.) inquired whether it is more desirable to depend on the manufacturer of the treating chemicals to supply the necessary equipment and oversee the application, or whether it can be done to better advantage if the railway owns the equipment and supplies the men necessary to handle it. Chairman Chinn replied that it was the thought of the committee that the manufacturers have a better knowledge of the materials themselves and the methods of application, and have acquired greater experience in handling than is likely to be possible with representatives of the railway, since they are doing this work continually, whereas a representative of the maintenance organization would do it only intermittently. There is considerable danger from poisoning and injury from this cause, unless the men operating the equipment are expert in its use.

P. J. McAndrews (C. & N. W.) said that his own experience has been such that he favors handling the chemical weed killing with the railways' own equipment and men. It takes only a short time to educate a man to handle it, and his observation is that the operators furnished by the contractor are usually young men from college who do not have more experience than the railway forces can acquire after a short period of training. As is well known, weeds do not grow uniformly over different sections of a railway or even of a division. For this reason, the application of weed killers is sometimes badly needed in one locality, while no application is required over the greater part of the division, so that it is of great advantage to have the equipment and the weed killer material available when its use can be made with the best results.

Chairman Chinn asked Mr. McAndrews how he proposed to keep a stock of chemical on hand, to which Mr. McAndrews replied that he is quite sure the chemical companies are willing to enter into arrangements which will enable the roads to keep a stock of chemicals on hand during the period when they will be needed, and that he is informed that this has been done in some instances.

It was then moved to amend this part of the report to read, "Some roads find it possible to purchase the chemical and make their own application, thus reducing the cost of weed control."

W. S. Hofford (U. P.) reported that it is the custom of his road to get a car of the concentrated chemical and hold it during the season, applying it with its own forces and equipment.

In answer to a question relating to possible damage to treated ties through the use of weed burners, Chairman Chinn replied that the investigations of the committee indicated that sound ties are not affected by the heat from weed burners and that the preservative is not leached or cooked out. Damage to ties from the flame apparently occurs only in untreated ties or ties that are badly decayed.

J. Sweeney (C. & E. I.) gave the experience on the C. & E. I. saying that it does not bear out the statement that the heat from the weed burners cooks out the preservative, but it does darken the ties, giving them an appearance indicating that some of the preservative has been brought to the surface. He has

never found any damage to sound ties from this cause. Mr. McAndrews said his observation is that the heat from the weed burner does draw out some of the preservative, but he is unable to see that any damage occurs as a result. So far as he has been able to discover, the action is no greater than that which is caused by the heat of the summer sun.

J. B. Kelly (Soo Line) expressed his belief that the association should be careful about sponsoring recommendations that may cause injury to treated ties. The investment in ties is very large and the intense heat seems to injure them, while it does actually set them on fire at times. The question then came up as to whether the use of the steam process of killing weeds might not cause the same injury to treated ties that was suggested as a result of the use of weed burners.

R. Kearney (C. & N. W.) said that where the steaming process is used it gives good results, but the method differs somewhat from other methods, in that it must be used earlier. In northern territory, with which he is familiar, the first trip over the lines should be made not later than June 1. A second trip should be made about six weeks later and a third trip as needed. If this practice is followed, excellent results will be obtained and the track kept clear of weeds.

In Florida, according to B. E. Haley (A. C. L.), where the growth of vegetation is extremely rapid and of great density, it is necessary to practice weed elimination during every month in the year. His road has used the steaming process for 12 years and weed burners for 6 years. It is his experience that, if the weed burner is used properly, the flame will not damage sound ties, nor does it tend to cook out the preservative. If the car is run at the proper speed, the weeds will be killed but the temperature of the tie will not be raised to a point where it is uncomfortable to lay a hand on it immediately after the passage of the burner. Where the growth is rank and dense, it is necessary to run the car at rather low speed, but after the first burning, the second application can be made at a much higher speed, and this tends to prevent the overheating of the surface of the tie.

The report was adopted as amended.

Controlling Cross and Switch Tie Renewals

REPORT OF COMMITTEE

L. M. Denny
Chairman

IN THE earlier years of railway transportation, the conservation of timber for cross and switch ties was not given much consideration. However, with the general expansion of the railways, the increased consumption of timber by other industries and the general devastation of forests in the advancement of agriculture, the use of timber in cross and switch ties has become of much importance. Railway officers who are confronted with the responsibility of keeping their tracks tied safely and economically, have done much to secure the full life of the timber itself, as well as to treat the timber with preservatives to prolong its life.

With this knowledge and with a desire to co-operate with our officers in their efforts to solve this problem, the executive committee of our association assigned to this committee the task of ascertaining and reporting on The Best Methods of Determining and Controlling Cross and Switch Tie Renewals. We hope, therefore, to give to the convention some ideas and recommendations which may be of benefit to our members and others interested in the use of tie timber.

The number of ties which a railway must purchase is fixed by the number which must be removed from track on account of the exhaustion of their service life, and those required for new construction. In order that the proper number of ties may be purchased for the ensuing year, an estimate must be furnished of the approximate needs. Where ties are treated, they must be purchased still further in advance to permit of seasoning and treating and may, then, be held in stock safely after treatment. Where untreated ties are used, care should be exercised to see that few are carried over. With careful inspection, there should be no occasion for over-purchase.

The cost of cross and switch ties and of their application constitutes a large percentage of the total expense of the maintenance of way department. This fact makes it most important that the full life of the tie, consistent with safety, be secured before it is removed from track. A tie designated for removal represents the cost of a new tie plus the cost of handling and applying it, as well as the cost of removing and disposing of the old one. This naturally leads to the question as to the employee who should assume the responsibility of saying when ties shall be removed from track and thereby decide the expense of the application of new ones. Can this best be done by one who is technically trained in the use of timber or by one who is practically trained and who is personally responsible for the safe and smooth riding condition of the track?

In order that the committee might learn the practice of the roads, a canvass was made of some 20 roads in the United States and Canada. In analyzing the 15 replies received, it was found that 14 of the roads depended on their section foremen, working under the direction of and with the supervisor or roadmaster, and that one road of approximately 600 miles uses a tie inspector, who makes the inspection with the section foreman.

Prior to the annual meeting of the American Railway Engineering Association in 1920, an investigation was made in regard to the use of tie inspectors. From this investigation the following data were derived:

Question	Miles Represented
Advocate field inspection by section foreman or others directly responsible for track	138,169
Against this method	10,591

Advocate field inspection by independent tie inspector	11,512
Against this method	93,042
In favor of this method, if section foreman accompanies tie inspector	23,674

After giving the subject careful thought and study, it is the recommendation of this committee that the section foreman should make the inspection of ties, working under the direction of and, as far as possible, with the next higher supervisory officer. It is also the opinion of the committee that there should be two inspections of ties annually.

A preliminary inspection should be made during the late fall for the purpose of securing an approximate estimate of the number of ties to be renewed during the following year, which estimate may also be used to determine the number of ties to be purchased, the funds necessary for the expenditure and the force that will be needed to do the work. The record of this inspection should be made by the foreman and should show the needs of each track and mile separately. The report should be checked and, where necessary, investigated by the supervisor or roadmaster, who should personally provide for such work as rail laying, new ballasting or other extraordinary maintenance. When this estimate has been approved by the proper officer, it can be given the purchasing agent for his attention.

It is the recommendation of the committee that, as early as practical in the spring, the section foreman should again inspect his ties and mark each tie that is to be removed, except where extraordinary maintenance is to be done. This inspection should be made by the use of such tools as will determine accurately the true condition of the ties, care being taken that serviceable ties are not damaged by the inspection. Where the next higher supervisory officer is not present at the time of this inspection, he should check the inspection to see that errors are not made. During the period when renewals are under way, the roadmaster should make a frequent inspection of the ties removed and this may well be supplemented by an occasional inspection by the division engineer or other maintenance of way officer to see that the roadmasters are economical in their use of ties.

In some instances, when engaged in extraordinary maintenance work on tracks in streets, road crossings or in other narrow confines, it is necessary and advisable to remove ties which would have further life in tracks of lesser importance. Where such is the case, the roadmaster should personally designate a place for such ties to be reinserted for it is only natural for a section foreman to dislike to use second hand ties.

Switch Ties

In the inspection and renewal of switch ties, it is the recommendation of the committee that the procedure be similar to that with cross ties. The committee recommends further that switch ties be renewed singly rather than by sets, for it is the opinion that, where ties are renewed singly, the turnout is stronger and produces a more uniform riding track. Also, a longer life is secured from all ties and the labor of reapplying ties is eliminated, which is necessary when ties are renewed in sets. A further saving is made because of the fact that when ties are renewed in sets, some are removed which still have some life, but not sufficient to warrant reapplying them.

Prior to the 1927 convention of the American Railway Engineering Association, some information was gathered as to the methods used in the renewal of switch ties. Of 26 roads reporting, 8 favored renewal by sets and 18 by piece renewals. As with cross ties, there are some places where it is advisable to renew all ties out of face, as in turnouts located in street crossings and in the confines of driveways, platforms and buildings. Serviceable ties removed from these places can be used in places of lighter service, selected by the roadmaster.

An Interested Group at the Steel Mill

On the section foreman and roadmaster belong the responsibility of safe tracks; likewise to them belongs the responsibility for the use and conservation of cross and switch ties.

Committee—L. M. Denny, chairman, supervisor, C. C. C. & St. L.; B. H. Briggs, vice-chairman, general tie inspector, B. R. & P.; L. Coffel, supervisor, C. & E. I.; W. A. Dibble, supervisor of track, N. Y. C.; C. S. Dodson, roadmaster, St. L. S. W.; W. O. Frame, district engineer maintenance of way, C. B. & Q.; B. F. Hanna, supervisor, B. & O.; R. L. Kittredge, asst. div. engr. C. & O.; J. B. Martin, gen. inspector of track, N. Y. C.; C. F. Nelson, general cost engineer, N. P.; P. Quinlivan, roadmaster, D. L. & W.; C. H. Shrier, general inspector roadway and track, A. T. & S. F.; I. D. Talmadge, roadmaster, N. Y. O. & W.; and W. T. Taylor, supervisor, M. C.

Discussion

The rather extended discussion of this paper brought out two sharply divergent views as to the proper methods of making the inspections for renewals. One group contended that a single inspection in the fall of the year is sufficient, and that an accurate estimate of the ties required for renewal the following year can be made from such inspection and that the ties which should come out can be definitely indicated within a limit of five or at the most 10 per cent.

Most of the speakers stated that, where they make the inspection in the fall only, it is customary to add from 5 to 10 per cent to the number counted, to cover ties which were thought fit to run longer than a year at the time of the inspection and to include such ties as might have failed, without prior indication that they would do so, before the time of renewal the following year.

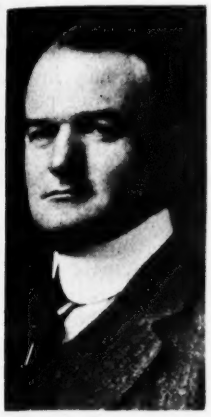
Others took the position that the fall inspection is merely for the purpose of estimating the number of ties which should be purchased, and that a further inspection should be made the following spring before tie renewals begin, to determine definitely the individual ties that should be removed from the track. Most of the speakers on this side of the question

were of the opinion that the section foreman, and not a special tie inspector, should make the inspection, particularly that which is made in the spring, because he is more familiar with his tie condition than any other person can be, and the spring inspection gives him the latest information from which the renewals can be made to best advantage.

The report was adopted without amendment.

What Do You Tell Your Neighbors About the Railroads?

An Address by L. A. DOWNS
President, Illinois Central



L. A. Downs

I DON'T KNOW of a department on the railroad wherein the men come closer to the public than the maintenance of way department. The section foreman is the biggest man in most of the towns; the road supervisor in the towns larger than those which the section foreman dominates; and the division roadmaster in the still larger towns. You come in contact with the people who mold public opinion, and public opinion is what is going to make the railroads successful or cause them to go down. If that statement is true, then we owe it to ourselves and to our railroads to give the public information that will mold their opinions of the railroad—not by propaganda that is not true, but the truth about the railroads.

In order that you may have a correct idea of the railroads at the present time, it is well to give you some historical facts. Railway history might be divided into four periods: The first period extends from the time the first railroad was built, over one hundred years ago, to 1887 when the first interstate commerce bill was passed. The second period, from 1887 to 1917, was the period of regulation. The third period covers the 26 months of federal control, and the last period runs from March, 1920, to the present time.

The Development Period

The first period, up to 1887, was one of great railroad building, when the pioneers stretched bands of steel across this continent. The leaders who headed the railroads in those days were individualists of the strongest type. They had peculiar ways of their own in which they accomplished their purposes. They did not agree with each other. They did not agree, even on the gage of the track.

Rebating became common practice and while none of us would favor rebates or would have much love for those who introduced them, we cannot but feel that these men did wrong at that time because it was demanded by the shippers. Preferential treatment of big shippers was demanded and any railroad which would not grant it, lost that business and much more, and faced bankruptcy.

These abuses and others and the increase in interstate commerce brought about the Interstate Commerce act in 1887. It hasn't been a bad thing for the railroads to have had it. It immediately increased their earnings and did many things. But the wrong part of it all was that immediately thereafter hundreds of bills affecting the railroads were passed by our national Congress and the state legislatures, so that public regulation of railroads got to be almost strangulation.

The second period extended from 1887 to the end of 1917. It was thought at that time that all laws should be of a restraining nature. Most of these bills carried heavy penalties for non-compliance, and it seems strange that the shippers in this country could not understand that all these penalties which the railroads had to pay were putting far away the day when railroad rates could be reduced and were bringing closer the day when railroad rates had to be increased to carry on the railroad operations. Prior to 1917 there were 37 different laws in various states regulating locomotive bells, 35 regulating railroad whistles, 32 headlights, etc.

Government Control

That period ended when the government placed the railroads under federal control on January 1, 1918. Many people thought it was strange that with the same officers and the same employees the railroads could operate under federal control and not under private control. It is no secret now. Men were leaving the service to go to war, many men were in France and others were in factories making war materials. Wages had to go up to meet the increased cost of living. The equipment had been worn out and new equipment had to be bought. The railroads could not raise the money. Particularly, they could not sell bonds in competition with the United States government, which was having a hard time to sell Liberty bonds.

So it was the proper and the right thing to do under the stress of war time in order that the railroads might live and be able to carry their financial burdens. You must understand that certain heroic measures have to be taken in war times and we must suffer the consequences if there are any ill effects at the present time. I need not say anything concerning that 26-month period. All of you are familiar with it. Most of you were working for the railroads during that time, and I dare say that none of us ever cares to go back to it, not even the shippers of the country.

The fourth period—from March 1, 1920, to the present time—will go down in history as the greatest period of achievement of the railroads of this country. The railroads not only returned to a pre-war-time basis but have improved their service and speeded up their traffic. They have spent in the neighborhood of three-quarters of a billion dollars each year for new and better equipment and to improve their lines. They have provided more tracks and yards and signals and brought about a condition that is second to none in the world.

The thing that made this possible was the law that was passed by Congress in 1920 when the railroads were taken back by their owners. It was called the Transportation act of 1920, and it will go down in histroy as the greatest document that has ever been issued by Congress since the Emancipation Proclamation. The law was not passed for the benefit of stockholders, it was not passed for the benefit of managements, it was not passed for the benefit of employees, but it was

enacted for the purpose of giving this country an adequate system of transportation. The fact that it has helped stockholders, managements, and employees and has also given good service to the American shippers, goes to show that their interests are not apart but identical.

What of the Future?

That brings the railroad history up to date. Now what of the future? Business men should be told that that is a question that they, not we, must answer, and their answer depends upon the attitude they will take towards various forms of other transportation. I refer to transportation by air, by highway and by inland waterways. Transportation by air is in its infancy. Aside from its use for pleasure and experiment and in a few passenger-carrying lines, the only real commercial benefit so far is the carrying of the United States mail. The assistant postmaster general, in testifying a short time ago before a committee in Congress, stated that the United States government was losing between five and seven million dollars a year in carrying mail by airplane, and that it was costing a dollar for every fifty cents that was received. Why should the United States government pay the balance if anyone wants to send a letter by air mail? However, even though the government is subsidizing airplanes, I see no serious competition with the railroads on that score.

The second form of competing transportation is that on the public highways. Since 1920, as all of you know, railway passenger earnings have gone down tremendously. In 1920 they were $1,280,000,000; in 1928 they were $900,000,000, a loss of nearly $400,000,000. My own railroad has lost $11,000,000 in passenger revenue. These are losses that in my judgment will never be recovered. They are due mostly to the private automobile and the private automobile is here to stay.

Highway Competition

But the greatest menace to the railroads is the trucks and buses engaged in common-carrier service. I believe that buses and trucks should be regulated for the same good reason that the railroads are regulated, not for the purpose of driving them off the highway, but for the purpose of fostering them, so that they can be co-ordinated with the railroads and be employed where they are a public necessity and be kept off the highways where they are not.

I believe, also, that the buses and trucks, in addition to paying the regular license fee that private automobiles and other trucks pay, should pay a tax that would replace the highways that they wear out. There is no reason why the government should furnish a facility for any business man to use without paying for it. There is no more reason for that than for the state to let any business man go into a court house or a city hall and set up his wares so that he may sell cheaper than an adjoining merchant. I am sure that this regulation is coming—motorists themselves are demanding it because these heavy trucks and buses are in their way on the highway—and when it comes and they are forced to pay the amount that is necessary to replace the highways that they wear out, I have no fear that there will be any serious competition from common carriers on our public highways.

Inland Waterways

Then there are the inland waterways. The papers have printed much about the big profit made by the federal barge lines on the Mississippi and Warrior rivers. Here are these profits in the last five years. I mean the net operating income or the amount taken in, less the expenses:

In 1924 they lost $532,611. In 1925 they lost $34,519. In 1926 they made $213,197. In 1927 they lost $21,808. In 1928 they made $327,712. So for the five years they lost $48,029. Now, at the end of 1928 when there was a "profit" of $327,712, every paper in the United States told what a lot of money the barge line was making and urged that it be expended to operate on all the rivers.

What of that $327,712? You will find that the barge line didn't pay any taxes. If it had paid taxes in proportion to what the railroads pay, say five per cent of its revenue (the railroads pay more than that), it would have paid $335,379 in taxes. If it had paid interest on the value of its equipment or on the money invested, as any private concern would have to do, five per cent on that investment would be $826,955. So in all, if the barge line had paid taxes and interest last year, there would have been a loss of $834,622 instead of a profit of $327,712.

Who paid the loss? The people who paid the loss are the people you should talk to in your public relations work. Every man who pays taxes paid that loss. The newspapers will tell you that it cheapens transportation, it saves the shippers 20 per cent. Nothing is more true than that, it does save them 20 per cent, because that 20 per cent is less than the freight rate. But who pays the collections taken in Oklahoma, in Tennessee, in Washington and in Montana from all the people in the United States to help the shipper who uses the barge line?

The man who uses the transportation ought to pay the full value of it. Do not misunderstand me. I am not opposed to transportation by air or on the highways; we are not opposed to inland water transportation. I am opposed only to the government subsidizing this transportation at the expense of the railroads.

If the Railways Were Not Taxed

The Class I railroads in the United States paid $376,000,000 in taxes last year. Now, if they were untaxed like the barge line, they could have reduced rates on all freight traffic eight per cent with no loss in net revenue. If they didn't have to pay interest and dividends, representing the hire of property used, they could have saved $1,180,000,000 more, or reduced rates 24 per cent without loss of revenue.

The barge line pays nothing for maintenance of way. And just now the government has all sorts of equipment at work below Memphis, taking the snags out of the Mississippi river. No doubt it is spending $10,000 or $20,000 a day to provide a channel for the barges. That isn't charged up to the barge line at all, that is a government appropriation.

Now, if, like the barge line, the railroads had no maintenance charges, they could have reduced the rates on all traffic 19 per cent. Therefore, altogether, if they paid no taxes, no return on property used and no upkeep, just as the barge line, they could have reduced all rates on freight traffic 51 per cent without any loss in net revenue.

But the people of this country don't seem to think about that. They just think about the cheaper rates that they will get by barge lines. So, as I said about the barge line and traffic on the highway and by airplane, if the government will keep out of it and make every shipper pay exactly what it cost to ship I have no fear for the railroads in this country.

The people of this country own our American railroads. They have $25,000,000,000 tied up in them. The

railroads are needed for an adequate system of transportation to take care of American shippers. Years ago people thought Wall street owned the railroads of the United States but there is nothing further wrong than that. There are over one million stockholders of railroads in this country, and many more than that interested in the bonds owned by universities, churches, hospitals, and schools. The railroads are owned by the people on Main street and not by the people on Wall street. And these main streeters are just as much entitled to a dividend and a fair return on their investment as anyone else who has any money to invest. I believe public opinion itself is going to be helpful.

We have nothing on the horizon that bothers us now, except these three kinds of transportation, and just as soon as the people understand, as soon as they know just what the newspapers and the politicians are talking about, and can think for themselves, I am willing to leave the fate of the railroads to the American people.

It is time for the people to think that the railroads are their railroads. They don't belong to anyone else. They are an integral part in everybody's business.

Getting the Most from Labor-Saving Equipment

By M. M. BACKUS
Assistant Chief Engineer Maintenance of Way,
Illinois Central System, Chicago

M. M. Backus

WHEN I was asked to read a paper before you men who bear the responsibility of maintaining our railroads, I hesitated in the fear that I might not be equal to the occasion, but as I studied the proposition I decided that if I presented, from the viewpoint of the railroad with which I am connected, the problems encountered in our use of labor-saving devices and told of some of the measures that have been taken to meet these problems, I might arouse a discussion that would bring suggestions that would be useful to my railroad. I say this because I have always been able to get many helpful suggestions from reading the discussions of this association.

We have used labor-saving devices for many years. In fact I presume that the use of labor-saving devices goes back to the time when we first had railroads to maintain, but it was during the late war that the lack of man power forced us into their more intensive use. To my mind no problem before the maintenance men is more important than the intensive use of labor-saving devices. I never forget what my general superintendent told me when I was a young roadmaster. I had over-run my allowance for the second successive month. He said, "Backus, anybody can have a good railroad if he pays no attention to the money that is spent." If we do not keep our labor-saving devices at work and have some means of knowing that they are at work, we are not paying proper attention to the way that money is being spent. Labor-saving devices, if kept at work, do one of two things. They either give a higher standard of maintenance with no increased expense or they keep a railroad in standard condition with a substantial *decrease* in expense. With the heavier wheel loads, increased speed and more dense traffic, the railroads would now be hard pressed to keep their roadbeds and tracks in safe and comfortable riding condition if labor-saving devices were not in common use.

We, and doubtless you, have equipment schedules which are used as the basis for daily rental charges when labor-saving devices are rented to other railroads or outside parties, or when used on tracks where other railroads or parties participate in the expense. This schedule is based on the first cost of the machine, its estimated life, the annual repairs and the number of days that the machine is normally used per year. These machines carry a rental rate of from 75 cents to $45 per day. If an outside concern can pay these rental charges and still make money, are we not losing the equivalent of this or more every day that the machines are idle during their working season?

We have used steam shovels, snow plows, clamshells, lidgerwoods, ballast and dirt plows, pile drivers, ditching machines, spreaders, and automatic dump cars for so long and they are so conspicuous on account of their size, and their use results in such tremendous savings that are so generally known that little or no trouble has been experienced in keeping them at work. And as there is in effect a comprehensive plan of inspection, followed by a program of repairs, they are usually available when needed. It is with the smaller and less proven machines that we have had our troubles. I might mention air compressors, power cars, ballast tampers, snow and ice-thawing apparatus, rail-laying machines, concrete mixers, ballast discers, mowing machines, weed-burning machines, wrenching, drilling and spike-driving machines, paint sprayers, portable pumps, oiling machines, adzing machines, etc.

The Investment in Labor-Saving Machines

It is estimated that in 1928 the Class I railroads of the United States were carrying an investment in labor-saving equipment of $400,000,000. The interest alone on this investment, at 6 per cent, amounted to $24,000,000, or enough to pay the wages of 27,600 section men working 8 hours per day, 306 days per year. The repairs to these machines during the same year amounted to approximately $26,000,000, or the equivalent of the wages of 29,900 more men working 306 days per year. The depreciation amounted to approximately $20,000,000. In all, there was paid out for labor-saving devices for Class I railroads last year $70,000,000, or enough to pay the wages of more than 80,000 men working 306 days per year, which $70,000,000 had to be earned by these labor-saving devices before any return was made to the railroads. It is evident that some means had to be adopted to

keep this equipment at work at least a large enough portion of the time to earn the carrying charges. To get at the problem intelligently it was necessary to know to what extent the machines were used. We had kept records for several years which gave us the output of the machines when in use, and by comparing the results with hand labor, we knew with reasonable accuracy, how much saving accrued when the machines were at work. There was, however, a tendency to overlook the repairs and the interest charges, and these, or at least the latter, were accumulating during the entire 365 days in the year.

The Monthly Equipment Report

Instructions were therefore put into effect that there should be included on the monthly equipment report, not only the individual number of the machine and its condition, but also the number of days that each item of equipment was worked. At the end of the year we worked up a statement listing the different devices, giving their first cost, the depreciation, the cost of repairs (not estimated, but taken from the accounts), overhead expenses, insurance and taxes, and the savings made per day when the machine worked. This gave the number of days a machine had to work before there was any return to the railroad.

In the case of the joint oiler, this would work out about as follows:

First cost, including freight and storehouse expenses	$7,600
Interest on invesemtn at 6 per cent	456
Insurance and taxes—1½ per cent	114
Money at 6 per cent set aside annually to replace at end of life (est. 10 yrs.)	577
Annual cost of repairs	436
Overhead—25 per cent of repairs	109
	$1,692

Machine made 23 miles per day
Saving, $3 per mile or $69 per day
Machine has to work at least 25 days to break even

In the last column of this statement we showed the number of days the machine had actually worked. This statement showed at a glance the individual machines on which we were losing money, and also showed where we were getting substantial returns from some machines and should consider making recommendations for additional machines of the same type.

The report was made by divisions and sent out for discussion. Two results were obtained. First, more attention is being paid to keeping the devices at work. Second, a number of divisions took exception to the report, saying the days worked, as shown, did not fully represent their activities. This, of course, was an admission on the part of such divisions that erroneous information had been given on the monthly equipment reports.

Second Report Showed Improvement

The second annual statement, made up in the same form as the first, indicated that we were securing better results, which were partly due to taking credit for the days actually worked, but—better yet—were due to more intensive planning and follow-up methods. Some divisions, of their own accord, now make a daily report on the activities of the work equipment assigned to them, and this report is carried by the roadmaster for discussion with the parties responsible for the performance of the machines.

The programming of work had much to do with this increased efficiency. For many years we have had a program for our ditchers, ballast-unloading devices, steam shovels and pile drivers, which was governed by the appropriation and the amount of work budgeted for the year. We felt that the programming should be extended to all of our labor-saving devices and should be done by the officer of the territory to which machines were assigned. That is, district machines should have the work scheduled by the district officer, division machines should be programmed by the chief maintenance officer of the division, and whole-line machines should be programmed by the Chicago office with the assistance of the district engineers.

Some machines, such as mowers, have their days of usefulness per year cut down because they are seasonal machines, but some days may be gained even with these machines. When we cut our swath with sythes we had a definite time, in early summer, for starting and completing the mowing of the swath, with all sections starting work at the same time and completing it within a given period. The time limit is now subordinated to getting more out of the machines. We now start work earlier as weeds need cutting and continue the work over a longer period. This enables us to get many more days work out of each mower.

When we oiled joints by hand we had definite instructions that main line joints should be oiled during certain spring and fall months. Now we have our oiling machines on a definite program and the oiling is done with the schedule date governing.

We are oiling joints with a machine for $2.41 per mile. This formerly cost us $5.40 per mile, but the first year this machine worked we secured only 159 days' service and oiled only 3,684 miles of track. Twenty-five days were lost waiting for oil, 10 days waiting for repairs, and 5 days waiting for the machine to be unloaded from a car.

This year we have two machines, which were put on a schedule the first of the year. One machine is now 15 days ahead of its schedule; the other is on time. A keen desire to make good on the schedule has been evident. To illustrate, we had quite a little argument between two of our district engineers as to whether delivery of the machine was to be made at "A" or "B." If at "A," the machine would be on time. While if it had to be deadheaded back to "B," the machine would be one day late. I mention this merely to show that the schedule is never lost sight of.

Setting a mark to shoot at and the taking of a personal interest by the supervisory officers have much to do with results obtained. One of our roadmasters asked the demonstrator how many miles of track should be mowed each day with a machine mowing swaths on both sides. The demonstrator, who had been loaned to the manufacturing company by us, had run the mower on one of the northern line divisions where vegetation was not so heavy and said he had made as high as 20 miles. The roadmaster insisted on a performance of 20 miles per day so strenuously that the operator finally appealed to the general officer who is in charge of motor machines to see the roadmaster and tell him that this might be an occasional, not an average performance.

More Machines Demanded

As long as we do not have sufficient machines to cover our entire territory, we are able to keep the days worked approximately to the proper number by transferring them from the man who does not use them to the man who does. This is evading the

Left—Secretary Donahoe talks it over with one of the editors. Center—At the entrance to the rail mill. Right—Chief Inspector R. B. Rouse of the Inland Steel Company explains some of the details of the process

issue, however, for, generally speaking, if a machine is economical for John, it is economical for Henry, and possibly Henry can be converted to its use. We had a case this year where a supervisor objected strenuously to using a machine well adapted for tamping gravel. He finally tried it out and within a week was asking for three more. It is hardly fair to condemn a man for not using a labor-saving device, however, if it is sent to him practically unannounced and he is told to put it to work and keep it at work. Usually there is no good reason why a man of mechanical turn of mind cannot be selected to run a machine and be on hand so that he can join the representative of the selling company in putting the machine in service.

There is more history connected with these tamping machines. The trial installation was on the territory of an alert roadmaster who kept a record showing in dollars and cents how much he was saving. He gave enough study to his organization to get it to the proper size, and had wonderful results. This information was passed over the railroad. More machines were requested and now our difficulty consists in being able to feed ballast material to them rapidly enough.

One need not always confine the work to that implied by the name of the machine. For instance, a rail-handling machine is often adapted to handling other materials, doing clamshell work, to decking bridges, etc. One of our men recently had a large amount of rail to load out of a pile. Instead of ordering an engine to furnish air for an air rail loader he took a compressor from a tamping outfit that was to be idle for a few days. The gang where the tamping was being done had plenty of work to do in dressing track and inserting ties ahead. And it got along nicely without the air compressor while it was supplying air for the rail loader.

One can, of course, overdo the variety of use. We had a paint spray on our oiling machine but never found time to use it, for the oiler could save us more money oiling rail joints than it could spraying paint, and we were able to get a spraying outfit for about 10 per cent of the cost of the oiler. Why, then, tie up a $7,600 machine when a $760 machine would do the work

I have mentioned the keeping of proper records once or twice. We keep a card index on each of our machines. This gives the first cost of the machine, the year purchased, the description, the days used during the year, the annual cost of repairs, and, in most cases, the amount of work performed. We do the same with our motor cars. When a requisition comes in, calling for a heavy list of repairs for any individual machine, this enables us to determine whether we should repair the machine or replace it with a new one, possibly of improved design. It was information of this kind that prompted us to discard some tamping outfits purchased in 1918 and replace them with machines of more modern design. In this case, the money spent for repairs and carrying charges was amounting to more than the savings we were making. Carelessness or indifference, which results in furnishing incorrect data, defeats the purpose of the record and it is, therefore, essential that the user of labor saving devices keep and furnish reliable figures.

One of the essentials in securing the maximum use of labor-saving devices is a proper system for keeping machines in repair. This requires a stock of repair material where certain items are used frequently enough to warrant their being carried in stock.

We have had for years a system equipment inspector who works with a mechanical equipment inspector and looks after the inspection and repair of steam-driven equipment, such as steam shovels, ditchers and lidgerwoods. They also handle spreaders and automatic air dump cars. The heavy repairs are made in our mechanical shops. This man also spends considerable time with the younger operators and helps break them in.

Our ownership of gasoline-driven machines has grown so rapidly that it was found necessary several years ago to put on a system supervisor of motor cars, who has general jurisdiction over the repair of gas-driven machines and works with the division motor car men in keeping this equipment in condition for service.

Repairs Given Preferred Attention

As we endeavor to have a designated officer advised when a machine is lying idle and available for use elswhere, we also encourage the use of the telegraph and telephone in case assistance is needed in getting a disabled machine back into service. Ordinarily, the divisions are able to keep their assigned machines in condition for use with their repair organizations, but occasionally we get a call in the general office for express shipments, and these are

given preferred attention, with close co-operation from our purchasing department.

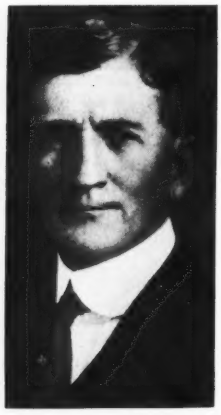
It is a big advantage to have machines operated by men who are mechanically inclined and interested in their output. We call on the manufacturers for service men where we think they are needed, but we feel that many a machine has its years of service materially decreased because of carelessness or lack of knowledge.

We include in our program of work to be done periodically, the following to be done in September:

The supervisor, in company with the motor car maintainer, must make an annual inspection of motor cars and all labor-saving machinery and devices, to know they are clean, that the bolts are tight and that they are being well maintained. Foremen should be required to turn up motor cars each pay day (easily remembered) for general cleaning and inspection.

Good Workmanship in Relaying Rail

REPORT OF COMMITTEE



C. W. Baldridge
Chairman

THIS committee was instructed to formulate standards of good workmanship in laying rail and recommend methods of insuring adherence to these standards. To insure good workmanship in the laying of new rail, it is necessary to begin by planning the work far in advance of the actual removal of the old rail and its replacement with the new rail. This planning must date back to the decision as to what rail is to be renewed in any given season, as well as to the part of the year that the rail should be relaid. If the new rail is to be laid in the winter, the track should be brought to the best possible surface a sufficient time before freezing weather sets in for it to be well settled and in good surface when the relaying is done.

Arrangements should be made, when the steel is ordered, to have it shipped on flat cars, or if flat cars are not available, the rail should be shipped in open cars to permit unloading it with power-operated cranes. Rails should never be shipped in stock cars or in any type of cars from which they cannot be unloaded by a crane, because it is necessary to drag the rails out of the rear ends of such cars by hooks and chains, and as a consequence the work train must be brought to a full stop each rail length. This not only makes the unloading of the rail much slower and more expensive, but the rails are much more likely to be damaged by being bent or nicked when dropped from the car than when being unloaded by a crane.

The Classification of Released Rails

Another problem which should be settled in advance is the classification and marking of the rails which are to be removed from track to indicate their suitability for future use. The classification should be indicated about as follows:

First Quality Relayers—One straight mark painted on the web of the rail near one end. This class includes rails suitable for reuse (as repair rail or otherwise) in the same class of track as that from which they are removed.

Second Quality Relayers—Two straight marks painted on the web of the rail near one end. This class includes rails (other than firsts) which are suitable for reuse in branch line running tracks.

Third Quality Relayers—Three straight marks painted on the web of the rail near one end. This class shall include all of the remaining rails which are suitable for reuse in side tracks.

Fourth Quality—Scrap—Marked with an X painted on the web of the rail near one end. This class, as the heading indicates, includes all rails that are unfit for further use in any kind of track.

Rail Laying Procedure

With these details completed, the rail laying should be handled as follows:

1. Run the tie scoring machine over the track which is to be renewed, before the unloading of the new rail is started. When starting the tie scoring machine, spot it with the saws over a sawn tie which is not plate cut, and adjust the saws so that they will touch the tie slightly but not enough to cut into it. This will result in the saws scoring all ties exactly to the level of the bottom of the tie plates in use.

Instead of the above, a tie adzing machine may be used while the rail is being renewed.

2. Assemble the cars of rails, fastenings, etc., at such points as will best suit the convenience of the work train when unloading.

3. When the rails are loaded on flat cars, mount two steel cranes on these cars, facing in opposite directions.

4. Provide each crane with a pair of eight-inch steel channels, five or six feet long, for use in running the crane from one flat car to the next as the cars are unloaded.

5. Have the work train pick up the car, with the crane facing away from the engine, then pick up as many cars of rail, of the desired class, as can be unloaded in a day, back of them pick up the car with the crane facing forward, and back of that pick up the cars of tie plates, spikes, bolts and joint bars, preferably in about this order.

6. Use a crane operator and six men with each crane, three on the car and three on the ground. Also place as many men in the cars of fastenings as may be necessary.

7. Have the work train move along the track slowly, with the cranes unloading rails as it moves and the men unloading the fastenings as required, at the same time.

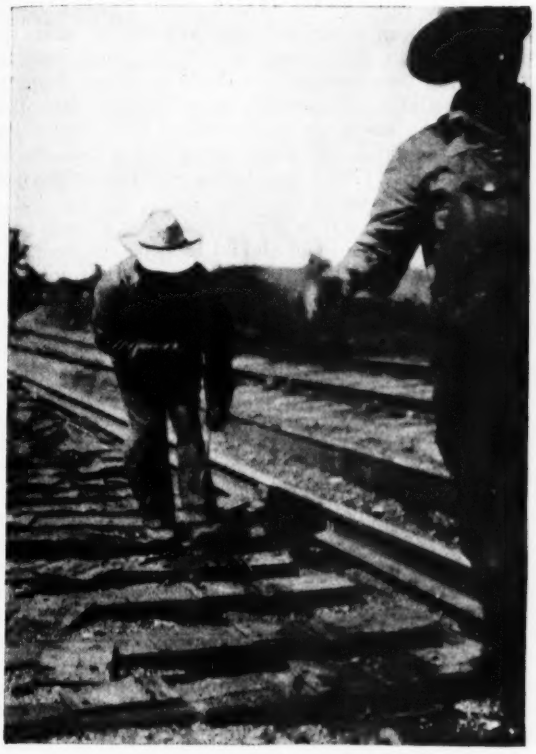
8. Do not permit the rails to be dropped, but insist that they be lowered to the ground with the crane under control.

9. It will usually be advisable to unload the rails for curves first so that the blue end rails may be distributed where most needed; then unload the inferior quality rails in the locations where the instructions permit of their use, and finally fill in the remaining tangents with such rails as may be left.

In unloading rails on curves, keep in mind that the inside rail on a curve is one inch shorter, for each degree of central angle of the curve, than the outside rail. The degree of a curve is the number of degrees

of central angle included in each one hundred feet of track; therefore, the degree of the curve is also the number of inches difference between the length of the two rails for each one hundred feet of track.

10. Nut locks and tie plugs should not be distributed with the other materials. Nut locks should be kept in the extra gang supply car and the tie plugs should be



Throwing Out the Tie Plates

unloaded at tool houses or other sheltered points where they will not be scattered and lost. Their distribution should be made by the tool car for the rail laying gang.

Preparations for Laying

11. Before beginning to lay new rail, prepare set-offs ready for the steel crane and such other power-operated equipment as is to be used on the job, either by utilizing existing hand car set-offs or by cribbing up with ties (old ones if they are available) at all points where it is too far to run the machines to a siding to clear trains.

12. When everything is ready for relaying rail, if on double track territory, have the track taken out of service during working hours.

13. In relaying rail on double track, work against the direction of traffic, and on single track work up hill if there is a prevailing grade, or against the major amount of daytime traffic.

14. Lay one side of a track only on each day and lay the rails on the opposite side the following day. This will permit the rail laid on the first side to become well settled and the tie plates seated before the second rail is gaged to it.

Place a slow order each evening, limiting speeds to ten miles per hour over the rail laid during that day. This will allow the rails to become seated without heavy thrusts of engine and car wheels, due to speed, and will help in maintaining correct gage.

15. When all is ready, begin laying by starting at some point where it is desired to locate a new joint for that side of the track. Use a short rail, or cut an old rail if necessary, to secure the desired locations of the new joints (for it is not usually desirable to have the new joints fall at the same location as the old ones).

16. If a tie scoring machine is not used, experienced men should adze, outside of the tie plates, all ties needing adzing, in advance of the rail laying work. Arrange to have the foreman in charge of this work accompany the gang, with a straight edge which will cover five or six ties, and check the adzing to make sure that good and true bearings are being provided for the new tie plates.

The Gang Organization

17. (a) When the gang is short handed, it is sometimes advisable to have the spikes pulled from alternate ties considerably in advance of the work, but if men enough are available, all spikes should be pulled at the same time.

(b) The lining-out gang should follow close behind the spike pullers and throw the line of rails out far enough to clear the ends of the ties.

(c) A man should follow the liners, throwing out old tie plates.

(d) One or two men, as may be necessary should then insert the plugs. Do not distribute tie plugs in advance, but, as they are light, each man inserting plugs should carry his supply in an old pail or a basket.

(e) Two or three men, using vertical-handle rams or tampers, can drive down the plugs as rapidly as the gang will progress, but it is always necessary to watch these men to insure that the plugs are driven to the bottom of the spike holes, for many workmen are prone to strike a slanting blow, half driving the plug and breaking it off at the same time. Each spike hole in a tie means that the wood fibers have been shattered and damaged and the treatment of the wood more or less punctured; it is necessary, therefore, that all such holes be well closed by the tie plugs.

(f) The adzers should keep close behind the tie plug drivers and, if the ties have been scored by saws, should cut out the new tie plate bed flush with the old bed and the saw cuts. Having three guides for the bottom of the adzing, accurate tie plate beds should be readily produced. If no scoring has been done, the adzers must be guided by the surface of the old tie plate bed and a competent foreman should watch the adzing closely to insure good results. Much of the inequality of the gage of track following newly laid rails is due to uneven tie plate beds, some of them tipping the rail in and others tipping it out. Careful adzing and accurate spiking are the two essentials of correct gage of track.

Adzes should be kept sharp and adzers should cut off the projecting tops of tie plugs and not break them off, as a broken tie plug leaves a ragged piece of wood which will hold moisture and invite decay.

(g) Following the adzers, a man with a stiff broom should sweep the tie plate bed as clean as is practicable and a swabber, equipped with a suitable swab or brush and a bucket of hot creosote, should immediately give the entire adzed portion of the tie, including the old tie plate bed, a thorough coating of creosote. To provide a supply of hot creosote it has been found desirable to place a creosote heater, together with the necessary barrels of cold creosote, upon a push car coupled behind the steel crane which is "laying in" the new rails.

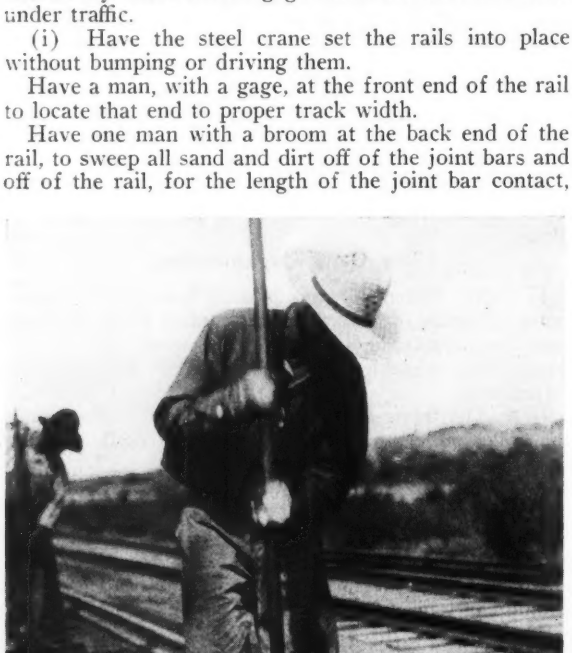
(h) Next have the new tie plates set in place. Use enough men on this work and insist that every plate be placed correctly, with no chips, particles of ballast, or other matter left under any part of the plate to tip or

cant it out of a true plane, for any such obstruction under the plate will tip the rail while it is being spiked and thereby cause erratic gage when the rail has settled under traffic.

(i) Have the steel crane set the rails into place without bumping or driving them.

Have a man, with a gage, at the front end of the rail to locate that end to proper track width.

Have one man with a broom at the back end of the rail, to sweep all sand and dirt off of the joint bars and off of the rail, for the length of the joint bar contact,



Driving Tie Plugs with a Vertical-Handled Ram

and another man with a bucket of oil and a brush to swab the inside faces of the joint bars, and the fishing faces and web of the rail, for the length of the joint bar contact, with oil.

Care must be taken to keep the rail and joint bars free from sand and dirt, as otherwise they will not bolt up to a good fit. Grit which may be sticking to the rail or joint bars is likely seriously to affect the slip of the rails through the joints, which is so necessary to take care of the expansion and contraction of the steel.

Expansion Precautions

(j) To provide for the expansion of the rails, use shims of the thickness authorized in the expansion table given in the book of rules, for the temperature which exists at the time the rails are being laid. To find the temperature, place a rail-laying thermometer on a shaded part of any new rail which is representative of all which are being laid, and after not less than three minutes' exposure, read the temperature of the rail. Then use the thickness of shim provided for the temperature nearest to that prevailing. The reason for taking the temperature reading upon the coolest part of the rail is that steel expands as it gets warmer, and the coolest steel is the shortest, so that expansion must be provided for a change in length from the shortest existing to the longest which the rail will attain in hot weather. If the temperature of the rail is half way between two temperature readings provided for in the table, a correct expansion will be secured by using alternately the shims provided for the next lower temperature and for the next higher temperature given, in the table. Usually the temperature of the rails does not change very rapidly; therefore, when a thermometer reading has been taken and the thickness of shim required has been determined, it will not, as a rule, be necessary to take another reading for a half hour or more. Readings will usually be necessary more frequently in the mornings and evenings than during the middle of the day. The temperature of the rails should be watched closely until experience tells how often new readings must be taken.

Shims should be left in place until 12 or 15 rails have been laid in advance, and should then be removed. If shims provided for one temperature are left in place until the rails have reached a higher range of temperature, the expansion of the rails will force them ahead, if possible, but when the string of rails already laid makes it impossible for the rails to push ahead, they will kink at the joints and buckle or bend sufficiently to take up the expansion. Such conditions are likely to cause improper seating of the tie plates and poor gage, particularly if the first train over the new rail passes while the rails are in this condition.

(k) The joint bolters should follow next behind the steel crane, and they should place and tighten all bolts in each joint. The center bolts of the joints, those through the holes nearest the ends of the rails, should be tightened first and those farthest from the ends of the rails last. This will insure the proper fit of the joint bars into the fishing spaces of the rails. With up-to-date power-operated wrenches, or bolting machines, any desired tightness of the bolts can be secured; therefore, the bolting machines should be set to tighten all bolts so that not more than one-quarter turn can be given the nuts with a 30-in. wrench, after they are set by machine.

The joint bolts should be gone over again and retightened a week or so after they are first installed.

(l) Following the bolters, a workman with proper tools should adjust the tie plates, where required, to the end that at no point will the base of the rail be riding the shoulder of the tie plate. Modern heavy rails are stiff enough so that a considerable length of the rail will be tipped if the edge of the rail base is riding the shoulder of a single tie plate, and if the rail is spiked to gage in this tipped position it will be out of gage when the tie plate is moved out of its correct position and a train or two has seated the rail to full contact with the plates in their proper plane.

Spiking

(m) Next in order should come the gage spikers. These should be among the most competent men of the gang in driving spikes straight and true. The number of ties per rail length which must be spiked to gage depends both upon which rail is being spiked and the kind of spiking which is to follow.

On tangents, when spiking the first new rail laid, it should be spiked to gage from the old rail on only two or three ties and they should be at points near the quarters. No gage spikes should be driven opposite a joint or any kinked spot of the old rail. Too frequent gaging of the new rail to the old rail results in spiking the kinks and irregularities of line of the old rails into the new rail and thus causes more work, both in gaging the second new rail and in lining the track. The first

line of rails should be gage spiked only often enough to keep a good workable width of track, then spiked as straight as possible.

On curves, both new rails must be gage spiked often enough to maintain the proper curvature, but even on curves one should avoid gaging the first rail from kinked joints, etc. In gage spiking the second new rail, if power-operated spike drivers are used, every third tie should be gage spiked by hand spikers for the first day or two. After the men have had a few days' experience with the machines, it should not be necessary to gage spike closer than every fifth tie, but one must be sure that the gaging is done well. Where all spiking is done by hand, every third tie at least should be spiked to gage.

(n) In gage spiking, the track gage should be placed so that it makes contact with the face (the top of the head) of the rail at all three points of the gage. The rail must then be thrown to contact with the downward projecting lug of the gage, *by the use of a lining bar,* and held there until the outside spike is driven. Under no circumstances should the rail be driven up against the gage by blows of a spike maul, the end of a lining bar, or any other tool. A great many rail failures, and particularly split web failures, are due directly to blows from a spike maul or other tool.

The inside spike must be so driven that it will hold the rail against the outside spike and to correct gage.

Full spiking of each rail should follow as closely behind the gage spiking as possible.

(o) Rail anchors should be applied as closely behind the spikers as is practicable. In placing these anchors, each pair must bear against the same side of the same tie. Also do not adhere to any fixed location for the anchors, except opposite slot spiked joints, but select sound ties on which the tie plates do not reach or overhang the edge of the ties against which the anchors must bear. Keep in mind, however, that anchors should not be placed against *adjacent* ties except opposite slot spiked joints.

18. All remaining expansion shims must be removed from the joints as soon as the rail anchors are applied.

19. Where the rail is laid in the summer, a "spot up" gang should follow closely behind the rail-laying gang and raise and tamp up all ties which are found to be low. Care must be taken in this work to raise the low ties, but not to raise them more than is necessary.

20. The old rails should be unbolted and all old joints, bolts, spikes, tie plates and rail anchors collected and piled where they can be loaded by means of a derrick with a magnet.

21. After the old rails are unbolted they should again be inspected and where kinks or flaws become visible which were not noticeable when the rails were in track, these rails should be reduced in classification and marked accordingly.

22. Have a clean-up work train follow as closely behind the completed rail laying as is practicable, particularly while the track is out of service, and load up the old rail by classes. A steel derrick mounted on the second of a string of flat cars can load the old rails, one class at a time, and save switching by backing onto the next car as fast as one is loaded. Another derrick with a magnet can load the old fastenings at the same time, with a considerable saving of work train time.

Essentials to Good Work

23. The most important details to watch to insure the correct laying of new rails are:

1. The proper adzing of the tie plate beds so that all of the tie plates will lie in the same plane, thus avoiding any tipping of the rails.

2. Making sure that no obstruction is left on the ties or on the tie plates, which will annul the correct adzing by tipping the plate and the rail.

3. Making sure that no tie plate is so placed that the base of the rail will ride the shoulder of the plate, which again will tip the rail and cause faulty gage.

4. See that the rail ends and the joint bars are clean and free from sand and dirt before the bars are put in place.

5. Give the new rails on the side of the track first laid, time enough under traffic to seat the tie plates and the rail properly before laying the new rails on the opposite side of the track, which must be gaged to the new rails first laid.

Speeding Up the Work with a Rail Crane

6. Drive all spikes straight and true against the rail while the rail is held firmly against the gage.

Keep in mind the fact that every spike which must be pulled and redriven in order to correct faulty gage is a waste of time because the men in the rail-laying gang can spike the rail to gage just as accurately as can the men in the surfacing gang or any other gang. Also, every spike pulled and redriven has damaged the tie and decreased its ability to hold the rails to gage, owing to the marks made by the tie plate ribs in the tie which tend to cause the plate to slip back into its first location; further, spikes must be redriven into one side of a plugged hole with a tendency to find their original locations.

See that new rail is so laid that no regaging will be necessary. Also keep in mind that the quantity of work done is important, but that the quality of the work done is much more important.

The only means of insuring adherence to any adopted standards of rail laying, is adequate and competent supervision, but considerable assistance can be rendered by impressing upon the minds of rail gang foremen that the quality of their work is of more importance than the quantity of work done. The most important aid

would probably be secured by discontinuing the practice so often used, of issuing a statement showing the number of track feet of rail laid by each gang each day or week. Such circulars are intended to stimulate the different gangs to strive for the largest number of track feet of rail laid in a given time, with no regard to the quality or completeness of the work done. The gang which wins the record for the number of feet of track laid per unit of time spent is usually the gang which leaves the most work for the surfacing gang or the section crew to do after the rail laying is supposed to be finished.

Committee: C. W. Baldridge, chairman, assistant engineers, A. T. & S. F.; W. Shea, vice-chairman, general roadmaster, C. M. St. P. & P.; W. A. Clark, supervisor, Reading; S. W. Cralle, roadmaster, N. & W.; R. M. Cunningham, general roadmaster, Erie; H. A. Halverson, roadmaster, C. & N. W.; G. G. Hewitt, roadmaster, Sou.; F. J. Liston, roadmaster, C. P. R.; W. F. Monahan, general track inspector, S. P.; A. E. Muschott, roadmaster, E. J. & E.; and W. H. Sparks, general inspector of track, C. & O.

Discussion

E. E. Crowley (D. & H.) objected to the second paragraph of Section 14, which provided for a slow order of 10 m. p. h. during the night after the rail had been laid to insure that the tie plates would be thoroughly seated. In his opinion this requirement was too drastic and would be seriously objected to by the operating department. E. P. Safford (N. Y. C.) endorsed this view, stating that in his opinion one train passing over the newly laid rail at slow speed would be sufficient and that the slow order could be raised for subsequent trains. Similar views were expressed by G. T. Donahue (N. Y. C.). Chairman Baldridge defended the requirement in the report, pointing out that present-day traffic calls for greater refinements in track construction and that with ribbed tie plates it was necessary that they be seated accurately if the track is to have accurate gage . It has been his observation that there are too many cases where the gage of track, after new rail had been laid, was so irregular as to require entire regaging during subsequent ballasting operations. This explanation seemed to satisfy the convention, as this part of the report was supported in a test vote.

Mr. Safford objected to the requirement of placing rail anchors opposite slot-spiked joints and to the requirement of selecting sound ties for the location of rail anchors rather than to follow a fixed spacing of the anchors which he considered preferable. In reply to this, Chairman Baldridge said that joint ties should not be anchored unless they are slot spiked and that the ties should be selected for the placing of anchor rather than to follow a uniform spacing. This opinion was based on an inspection of track in which he had found two-thirds of the anchors were bearing against tie plates that overhung the edges of the ties, a condition that was obviously objectionable. E. C. Buhrer (N. Y. C.) objected to the placing of tie plates ahead of the rail, preferring to lay the rail first and insert the tie plates under it by nipping it up.

The Stabilization of Forces

By H. S. CLARKE
Engineer Maintenance of Way, Delaware & Hudson

BY THE invitation of your executive committee to prepare and read a paper to you on the stabilization of maintenance-of-way forces, you have conferred a great honor upon me, as there is no problem which is attracting greater interest among trackmen today than this. Since the earliest days, maintenance-of-way work has been regarded as seasonal, with the greatest activity in the summer, and with approximately one-third of the maintenance-of-way forces being laid off each fall in the annual reduction to a "winter basis." The emphasis which President Hoover has placed on permanence of employment in industry and the comments of railway officers themselves indicate the growing importance of this subject.

A committee reporting to the annual convention of the Roadmasters' Association in 1916 on the seasonal distribution of maintenance work and forces, stated that "The committee is not in favor of standard maintenance forces the year around; it is necessary to take care of the heavy section work in from five to eight months," adding that the distribution of section work the year-around was impracticable. Although the association amended the report and voted in favor of working towards the system of uniform maintenance forces throughout the year, adopting it entirely where feasible, there was still sentiment against it.

Maintenance of way operations have been used for years as the balance wheel of the operating department, for mandatory cuts in maintenance forces can be made without disturbing train schedules. This has been the cause of the work being disrupted again and again, with the resulting added cost of doing necessary work or the prevention of work being done that was necessary, if the railroad was to be operated economically.

Maintenance work cannot be handled piecemeal; it must be organized for the season or for the year; better still, many items of maintenance work, particularly in the bridge and building department, can be organized on a five-year program. Therefore, the first step toward the stabilization of maintenance forces is to get the maintenance-of-way appropriations made for the year, and all seasonal restrictions taken off, with the object of doing the work most economically. The appropriation should be based on the estimated earnings for the year, with due regard to the physical condition of the road.

If the actual earnings are found later to be falling below the estimated earnings, and it becomes necessary to economize, arbitrary cuts should not be made in one or two months, but the amount of the saving to be made should be determined and, instead of being required to make this saving by drastic cuts in labor or in one or two items of material, the maintenance of way department should be advised of what is expected of it and then allowed to distribute the cut over the balance of the year, in the manner in which it will least affect the program and organization.

With our uniform forces on the Delaware & Hudson, we have had, at times, to make such reductions in our maintenance expenditures, and have made them

in this manner with very little disturbance to our program or organization. Every item of expense is carefully considered and cuts are made here and there sufficient to meet the required amount finally. Each roadmaster is advised of the amount that it is necessary for him to save, with recommendations as to the manner in which it is believed the saving can best be made, although he is allowed to depart from these recommendations to meet his own conditions. Under such a program, we have not found it necessary to cut our forces, although in extreme conditions we have gone on a five-day week basis for short periods.

The full benefits of stablized forces are not realized at once, as it takes time and hard work to develop the many necessary steps leading to it and to get all concerned working whole-heartedly for it, but once the corner is turned, the results are surprising and the benefits are far greater than is now generally realized by maintenance-of-way men. No one who has worked under this scheme would ever think of going back to the old way.

Must Have Support of Roadmasters

To succeed, any such scheme must have the full support of the roadmasters and supervisors and such success as we have had, has, in a very great measure, been due to the manner in which our roadmasters, whether they agreed fully with us in any new ideas, were so willing to give it a trial and to go ahead with the one and only one idea of putting it across and improving on it as much as possible. With such co-operation, any scheme with merit will be a success, and to be successful and to progress this spirit is essential.

In 1924, we had been laying rail in the winter for several years and I am going to quote several paragraphs from a letter that I wrote our roadmasters and supervisors through our channels on November 5, 1924:

> It has been the practice for several years to lay rail during the winter months, and while this probably costs more per ton of rail laid, depending on the weather conditions, the advantage is that it is out of the way and does not interrupt the regular work during the other seasons; however, the greatest advantage from an economical standpoint and one which is often overlooked, is the utilizing of the time of the regular necessary winter force on constructive work in the good weather periods and this can only be done by carefully organizing the work.
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> The greater the amount of constructive work than can be carried on in the winter, the more uniformity will there be in the force necessary throughout the year, for with a given amount of work to be done, it requires no elaborate argument to demonstrate that a smaller force of men working continuously throughout the year will accomplish more and at less cost than a larger force hurriedly organized and less experienced will do in a shorter period.

While we had already started winter work at this time by laying our rail in the winter and were beginning to secure some of the benefits, we were far from satisfied and were still a long way from arriving at a stabilized force.

Extracts from a letter I wrote to the assistant to our general manager in charge of personnel in December, 1924, indicate our progress and our troubles:

> On a good portion of our maintenance work, it is possible to develop plans and methods and instruct our supervisors and foremen in these methods, and through them the men, provided gangs are maintained on a basis that will insure an adequate number of men who have sufficient experience to insure that they will become skilled workmen; it may be possible to plan and instruct men, it is impossible to teach them how work should be done. This is something which the man must have learned previously in the course of his employment in the gangs, so that probably one of the biggest problems in our work is to secure the greatest uniformity of force throughout the year, to eliminate the labor turnover.
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> Maintenance work, with the diversity of problems which come within its scope, is becoming increasingly attractive to young men of technical education, particularly in view of the possibility of advancement to a higher operative or executive position, and this has greatly simplified our problem of securing technical men willing to start out and secure the proper practical training and has brought to the foremen and others the desirability of these positions and thus stimulated competition. Each avenue of training has its advantages for the young men of energy and ability; each benefits from competition with the other. On one hand, a man of practical training is aided because of the necessity of applying himself diligently to the study of methods of organization, control of cost, etc., to meet the standard of his neighbor in this respect; likewise, the man who has entered track work through the other channel, must study the practical phases of maintenance work in order to avoid the pitfalls of inexperience.
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> This is being demonstrated by our own experience and has resulted in a great improvement in our supervisory force where we now have many young men, college graduates, and also ambitious men from among the foremen and clerical staff, working on the track as supervisors, who are clearly demonstrating their ability quickly to become competent and efficient in their work, resulting in their work being more uniform and being better handled and developing for us a very desirable class of men to draw from.
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> Probably our greatest problem is with our laborers or trackmen. Trackmen require skill and knowledge of how and what to do in order to maintain track. Our greatest drawback in securing improvement in maintenance work is our difficulty in improving the quality of the men and holding them with the present rates and conditions. Our studies develop that the efficiency of the new man is very low and that it is false economy to use cheap labor with no experience and with no intention of making it a regular vocation. Both the quantity and quality of work performed by this class of labor bears out this contention.

To overcome our difficulties in the above matters, our forces were studied and changes made which we believe have made the work more desirable. Our foremen were changed from hourly rated men to a supervisory class, receiving a monthly rate of pay covering all time worked, with two weeks' vacation each year with pay and protection during illness. Today, on the Delaware & Hudson, with group insurance covering all employees, the foreman does not have the worries that he formerly had as to what would become of his family during an illness, for, in addition to the insurance protection, the company sees to it that his family is properly taken care of and a foreman seldom loses a day's pay through illness.

Improved Status of the Foreman

He does not receive overtime for emergency work and his hours vary from eight to ten hours per day, the ten-hour day not to exceed three months in any one year. He is protected against working on Sundays and holidays on work that is not of an emergency nature and which could ordinarily be handled on another day; when he is required to do such work on holidays, he receives a bonus, and for extended periods of overtime work during heavy snow storms or washouts, he is given a bonus, on the recommendation of the roadmaster, for exceptional service.

Assistant foremen are on the same basis as the foremen, receiving a monthly rate of pay under practically the same conditions. We create a great number of positions for assistant foremen and even on some of our smallest sections we have assistant foremen. Young men with common school education are encouraged to enter the railroad service, and likely looking trackmen are promoted to assistant foremen's positions.

To provide for these men to secure experience in the various operations and in handling men, as the

opportunity occurs, they are bunched in small gangs on special work, each man in the gang at different times being given the opportunity to handle the work under the general supervision of a supervisor or experienced foreman; thus we have experienced men to relieve the foreman in his absence and to promote to foremen as vacancies occur.

For trackmen, we have an entering rate which is increased five cents an hour at the end of six months' service and from then on for five years, he receives an increase to his hourly rate each year. With the continuity of employment by the distribution of the work over the entire year, this gives the men an incentive to stay on the job and discourages them from leaving the service to secure work for a few months on highway or other short construction jobs paying a high rate and then expecting to return to the railroad at the end of such work. Men voluntarily leaving the service for such purposes lose the high rate they have earned and if engaged at all, start in again at the entering rate.

Group Meetings and Classes

Group meetings of foremen are held from time to time with the roadmasters and supervisors to afford opportunity for the discussion of standard methods. Classes for foremen are also held by supervisors, covering certain specified transportation rules, motor car rules, safety-first instructions and first-aid work, in which the foremen are required to qualify. Traveling timekeepers are employed under the supervision of the accounting department to check up and instruct foremen in the proper distribution of the time and material used.

Roadmasters, bridge and building masters, supervisors, members of the engineering corps (and such maintenance of way clerks as desire to) are required to study, in addition to maintenance of way work, all of the transportation rules and qualify in these rules before the regular rules examiner.

To stimulate competition, several thousand dollars in prize money is distributed to the foremen making the best showing during the year, the selection being made after the annual track inspection; in making these selections, the foremen are penalized to a considerable extent for any excessive man hours over the standard basis set for their sections. The result of this is that instead of the roadmaster being continually asked by the foreman for assistance from an extra gang, he now gets a protest from the foreman if he suggests moving an extra gang on a section.

In reply to a questionnaire from the editor of *Railway Engineering and Maintenance* this year, relative to stabilization of labor I was able from our experience, to make the following reply:

Uniform maintenance of way forces are practical on our line throughout the year. We do, for several months in the summer, extend the working day from eight to nine and occasionally to ten hours a day for limited periods. The only necessity for an additional force in the summer and spring is when the maintenance forces are required to undertake any large construction work.

There are numerous objections to reducing forces each autumn. Laying off men in the autumn means hiring men again in the spring—many with little or no experience, whereas work, to be efficiently handled, requires skilled men familiar with it. Continuity of employment is essential to efficiency, while labor turnover is destructive. The uniform distribution of work over the various months to best suit our climatic conditions results in decreased maintenance cost. Permanency of employment increases the efficiency of the track forces. All conditions considered, we are finding it considerably cheaper, on the whole, to lay rail in the winter and to do such other work as is possible in the late fall months and in the winter; that is, considering the amount of work accomplished throughout the year as against the total man hours used.

Possibly, our winter force formerly employed was larger than is carried on some roads, owing to the amount of snow and ice that it is necessary to handle, but we have found that this same force, formerly called a winter force, does not need to be increased to carry out our winter work as now laid out, and in carrying out this winter work and getting it out of the way we can carry on throughout the balance of the year with this same winter force, by increasing the working period from eight to nine hours for limited periods.

The more experience we have had with winter work, the better are the results.

The maintenance work on the Delaware & Hudson has for several years been uniformly distributed over the various months to meet best our climatic conditions. Our yearly program of rail and track material, etc., has been uniform and requisitions for track material and rail are placed months ahead, assuring us of set delivery dates. While at first, we had some trouble getting the forces used to winter work, they all now so thoroughly realize the advantages and are planning their work ahead so carefully that each year shows a substantial improvement in the amount and class of work accomplished.

I believe and anticipate that all railroads will shortly realize the benefit in uniform forces and that there will be a decided trend towards working this problem out on each railroad to meet their special conditions because the labor saving in maintenance that can thus be made is too great to be overlooked by any railroad.

I am not going into the details of the actual work of winter rail laying as you have had committees working on this problem and have covered the ground in a very excellent manner; however, I will say a little about the actual benefits secured by the Delaware & Hudson company.

The number of trackmen on the D. & H., with less than six months' experience has decreased 65 per cent from those employed in 1926.

The labor turnover has been greatly decreased.

Our entire force before the winter work program was put in, varied from 2,400 men in the winter to 3,400 to 4,000 men in the spring and summer. In 1928 our total maximum force, disregarding 200 men employed on a construction job who were laid off in February, 1928, was 2,525 maximum and 2,465 minimum, a variation of 60 men.

What the Record Shows

In 1929, our maximum force was 2,593 men and our minimum 2,457, including 70 men on construction work, a variation of 136 men.

Our average rate of pay in 1928 was 5 per cent over 1920, our decrease in total maintenance of way payroll was $1,228,467, or 19 per cent.

Our average rate of pay in 1928 was 6 per cent over 1921, our decrease in total maintenance of way payroll was $708,629, or 19 per cent.

Our average rate of pay in 1928 was 15 per cent over 1922, our decrease in total maintenance of way payroll was $720,846 or 19 per cent.

Our average rate of pay in 1928 was 13 per cent over 1923, our decrease in total maintenance of way payroll was $257,565 or 8 per cent.

Our average rate of pay in 1928 was 13 per cent over 1924, our decrease in total maintenance of way payroll was $553,808 or 15 per cent.

For the years 1927, 1928 and 1929, we have had a really uniform force, although in 1927, during the fall months, our record was partly ruined, due to the Vermont flood, which destroyed a part of our line and required several hundred extra men for reconstruction; such emergencies will occur from time to time and cannot be foreseen or avoided. While this saving undoubtedly is not all due to the stabilization

of forces, a very large percentage of it is, and many of the other items contributing to it are necessary and a part of the development of the scheme, such as improved supervision, labor saving machinery, etc. Probably the best proof of the success of the plan is that with this decrease in payroll in 1927, 1928 and 1929, we have had better track conditions and improved general maintenance conditions than ever.

While great credit is due to our division engineers, roadmasters and supervisors for the splendid manner in which they have handled this matter and made it a success, the plan could not have been at all possible if it had not been for the foresight and progressiveness of our president and management in providing the opportunity, backing and patience necessary to the development of the stabilization of forces.

The Track Supply Exhibit

FOR THE eighteenth consecutive year, the Track Supply Association presented an exhibit during the three days of the convention. From the very start these exhibits have occupied a room adjacent to the convention hall, but in no previous year was the exhibit shown under such favorable auspices. The room was an unusually large one and owing to the facilities available for the delivery of heavy and bulky units to the exhibit hall, the exhibitors displayed more than the usual proportion of full-size devices, rather than models or parts. The fact that the exhibit was held in so important a railway center as Chicago also resulted in a larger attendance than usual.

The officers of the Track Supply Association, who are responsible for the preparation and conduct of this exhibit, are: President, F. E. McAllister, president and general manager, Kalamazoo Railway Supply Company, Kalamazoo, Mich.; vice-president, L. P. Shanahan, American Steel & Wire Company, Chicago; secretary-treasurer, L. C. Ryan, representative, Oxweld Railroad Service Company, Chicago; directors, Wallace W. Glosser, Pacific coast manager, electric dept., Hubbard & Co., Oakland, Cal.; D. J. Higgins, American Valve & Meter Company, Chicago; L. S. Walker, eastern manager, P. & M. Company, New York; George T. Willard, salesman, Railway Supply Company, Chicago; advisory directors, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago; R. A. Van Houten, vice-president, Sellers Manufacturing Company, Chicago; honorary director, H. R. Clarke, president, Roadmasters' and Maintenance of Way Association, Chicago.

In the election of officers, Vice-President Shanahan was advanced to president, Mr. Higgins was made vice-president and Mr. Ryan was re-elected secretary-treasurer, while A. L. Greenabaum, vice-president of the O. F. Jordan Company, East Chicago, Ind., and W. B. Maurer of the American Hoist & Derrick Company, St. Paul, Minn., were elected directors.

Following is a list of exhibitors, with the materials exhibited and the names of the representatives of each firm:

List of Exhibitors

American Chain Company, Inc. (Reading Specialties Division), Bridgeport, Conn.; guard rail clamps, one-piece guard rails, rail benders and compromise joints; J. J. O'Connell, A. H. Weston, and W. I. Clock.

American Fork & Hoe Company, Cleveland, Ohio; rail anchors, tapered rail joint shims, safety rail fork, ballast forks, rakes, scuffle hoes and broom rakes; A. F. Fifield, S. L. Henderson, J. T. Reagan, E. Keough, F. C. Stowell, J. Christie, R. C. Violett, J. J. Nolan, J. H. Dooling, C. E. Irwin and F. J. Reagan.

American Hoist & Derrick Company, St Paul, Minn.; illustrations and photographs of locomotive cranes; Ward B. Maurer, Helen Hoeller, A. Harvey, A. Craine, J. L. Hickey and D. L. O'Brien.

American Steel & Wire Company, Chicago; fencing, fence posts, signal wire, bonds, wire rope, nails, concrete reinforcement and snow-fence posts; T. Haskell, A. W. Froude, C. A. Cochrane, L. P. Shanahan, E. E. Aldous, W. Floto, C. S. Knight and C. F. Wiley.

American Valve & Meter Company, Cincinnati, Ohio; wheel flange and rail lubricators, switch stand, and rail joint clamp; J. T. McGarry, J. W. McGarry and D. J. Higgins.

Bethlehem Steel Company, Bethlehem, Pa.; rail anchors, switch stands, hook-flange guard rail, gage rods, braced flangeway guard and track bolts; N. E. Salsich, R. P. Deghuee, C. Cecil, J. L. Tygart, G. L. Moore, G. Oyer, G. Riddle and C. Y. Phillips.

Boss Bolt & Nut Company, Chicago; lock nuts; R. J. Shanahan, H. E. Burns, J. P. Crowley and George Hanley.

Buda Company, Harvey, Ill.; motor cars, jacks, track liners and rail benders; R. B. Fisher, H. M. Sloan, R. M. Blackburn, J. T. Jung, E. H. Walker, J. J. Gard, O. H. Brauer, G. A. Socor, E. L. Kastler and S. P. Reid.

Philip Carey Company, The, Cincinnati, Ohio; crossing materials and water-proofing materials; E. J. Van Landeghem, V. R. Muth and A. A. Chenoweth.

Chicago Steel Foundry Company, Chicago; track liner; David Evans, C. M. Evans, H. J. Georgen and W. J. Chapin.

Chipman Chemical Engineering Company, Bound Brook, N J.; skid type weed sprayer, plans of other types of weed spraying equipment, and dry chemical, weed killer; E. C. McClintic, A. F. DeVault and J. T. Darby.

Creepcheck Company, Inc., New York; rail anchors; T. D. Crowley, N. A. Howell and V. L. Walker.

Crerar, Adams & Co., Chicago, tool handles, snow brooms, track drills, hacksaw blades, metal-cutting, band saws, rail saws, bonding drills, shovels, lawn mowers and track liners; Russell Wallace, E. C. Poehler, R. M. Bullard, W. L. Riedell, G. D. Bassett and J. M. Temple.

Cullen-Friestedt Company, Chicago; motion picture of rail and locomotive cranes in operation; F. P. Cullen, William C. Bamber, E. V. Cullen, R. W. Payne, G. H. Penglase, F. J. Reagan, C. J. Bronez and K. J. Beller.

Dilworth, Porter & Co., Inc. (Division of Witherow Steel Corporation), Pittsburgh, Pa.; tie plates, special die rolled sections, guard rail fastenings and track spikes; W. T. O'Neill and Thomas Maney.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.; track jacks, automatic lowering jacks and tie spacers; E. E. Thulin, C. N. Thulin, W. G. Robb and Albert Roberts.

Edison, Thomas A., Inc., Bloomfield, N. J.; electric-lighted switch lamp, primary and storage battery cells and parts, night box for motor cars, and small hand lantern; F. S. Stallknecht, C. R. Heron and P. A. Garrity.

Electric Tamper & Equipment Company, Chicago; rock type tie tamper and gravel or light-ballast tie tamper; C. Jackson, V. G. Cartier, M. S. Westlund and H. W. Cutshall.

Fairbanks, Morse & Co., Chicago; motor cars; B. S. Spaulding, F. M. Condit, D. K. Lee, J. L. Jones, F. J. Lee, E. C. Golladay, P. H. Gilleland, H. L. Hilleary, E. P. Chase, C. H. Wilson, H. J. Smith and G. W. Lewis.

Fairmont Railway Motors, Inc., Fairmont, Minn.; Fairmont and Mudge products, motor cars, cutaway model of motor car engine, wheel axle-bearing assembly and model of trailer frame; Albert C. Force, W. F. Kasper, Robert D. Sinclair, K. K. Cavins, A. R. Fletcher, W. D. Brooks, V. Pagett, C. H. Johnson, C. P. Benning and C. E. Green.

Gardner-Denver Company, Denver, Colo.; power tie tamper, portable compressor and tie tamper, concrete breaker, spader and rock drills; Robert P. Leonard, R. J. Watson, Lawrence Loewe and T. H. Driscoll.

Hayes Track Appliance Company, Richmond, Ind.; models of derail, bumping posts and wheel stops; A. W. Booroom, E. L. Ruby, Herbert J. Mayer, E. W. Brown, Oran Perry and S. W. Hayes.

Hayward Company, The, New York; clamshell buckets; H. C. Ryder, C. S. Sergent and R. W. Hawkins.

Hubbard & Co., Pittsburgh, Pa.; shovels, track tools and nut locks; J. S. Wincrantz, W. H. Remmel, S. F. Remmel and C. Konold.

Hultgren, Anderson & Mikkelson, Warwick, N. D.; one-man tie puller; J. H. Mikkelson, Emil Hultgren and Charles Anderson.

Indianapolis Switch & Frog Company, Springfield, Ohio; paver plates for grade crossings; E. C. Price.

Industrial Brownhoist Corporation, Cleveland, Ohio; photographs of ballast cleaning machine, locomotive crane and wrecking crane equipment; G. F. Climo, Jr., C. H. White and R. P. Williamson.

Ingersoll-Rand Company, New York; pneumatic tie tamper, rail drill, nutting machine, concrete breaker, spike puller, spike driver and scaling tool; W. H. Armstrong, G. W. Morrow, F. J. Ursem, T. H. Wiegand, G. E. Bridge, L. A. Luther and M. J. Rotroff.

Jordan Company, O. F., East Chicago, Ind.; moving pictures of spreader and track oiler; A. L. Greenabaum, H. W. Protzeller and J. H. Mulholand.

K & W Equipment Company, Chicago; photographs of rail laying crane; A. Verne Jackson and G. T. Burrell.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; motor cars, supervisor's track gage and level; F. E. McAllister, R. E. Keller and L. W. Bates.

Keystone Grinder & Manufacturing Company, Pittsburgh, Pa.; hand and power-driven tool grinders; L. J. Cooney and S. S. Newman.

Lundie Engineering Corporation, New York; tie plates; L. B. Armstrong, George W. Nibbe, Eugene Brandeis and James C. Barr.

Maintenance Equipment Company, Chicago; switch point protector, rail and flange lubricator, model of friction car stop, literature on hand and power rail layers, power track ballaster, flange and rail lubricator and fence posts; A. L. Arnold, J. A. Roche, H. C. Holloway, E. Overmier and Clifford Hogan.

Mechanical Manufacturing Company, Chicago; bumping posts; H. E. Johnson and T. L. Zapf.

Morrison Railway Supply Corporation, Chicago; frog and switch points; C. J. Diver, F. C. Cullen, E. W. Smith, Harry Mersey, R. L. Morrison, M. B. Morrison and H. L. Morrison.

National Carbide Sales Corporation, New York; flood lights and carbide; R. C. Holcomb, E. C. Ackerman and F. E. Mull.

National Lock Washer Company, Newark, N. J.; spring washers; G. LaRue Masters, W. R. Hillary, R. L. Cairncross, A. T. Hyatt and W. E. Bugbee.

Nordberg Manufacturing Company, Wilwaukee, Wis.; adzing machine and power jack, and motion pictures of track shifter and raiser and full revolving track cranes; W. W. Fitzpatrick, Victor F. Larson, H. H. Talboys, A. C. Harrison, E. R. Mason and Gus Geer.

Northwestern Motor Company, Eau Claire, Wis.; heavy-duty motor car; A. H. Nelson, Otis B. Duncan, Allan Datesman and G. H. Goodell.

Oxweld Railroad Service Company, Chicago; welding and cutting apparatus; L. C. Ryan, W. F. Kofmehl, J. E. Winslow, F. J. Duffie, W. E. Campbell, F. J. Lurquin, D. H. Pittman, L. A. Woodward, C. A. Bloom, M. C. Beymer, W. Leighton, E. S. Richardson, H. W. Schulze, J. G. Tawse, J. J. Saelens, F. C. Hasse, E. Cordeal, A. N. Lucas, W. A. Hogan, W. Jones, J. D. Dunbar, R. J. Nenneman and G. M. Crownover.

P. & M. Company, Chicago; anti-rail creepers and bond-wire protectors; L. E. Borst, D. T. Hallberg, G. E. Johnson, J. E. Mahoney, C. E. Webster, L. S. Walker, T. J. Byrne, S. M. Clancey, E. H. Reaves, C. H. Norwood, Jr., W. A. Maxwell, W. G. Cunningham and P. H. Hamilton.

Pettibone Mulliken Company, Chicago; switch stands, mechanical switchman and manganese guard rails; G. J. Slibeck, A. W. Swartz and C. A. Johnson.

Pocket List of Railroad Officials, New York; copies of publication; B. J. Wilson.

Positive Rail Anchor Company, Chicago; girder type guard rail, rail anchors, and guard rail plates and braces; A. H. Todd and L. C. Ferguson.

Q. & C. Company, New York; guard rail clamp, compromise joint, switch point guard, flangeway guards, derails, one piece guard rail and foot guards; J. L. Terry, L. Thomas and L. E. Hassman.

Rail Joint Company, New York; insulated joints, standard joints, compromise joints, head-free joints, reinforced joints; Alexander Chapman, D. L. Braine, H. C. Hickey, C. B. Griffin, J. N. Meade, Charles Jenkinson, E. B. Bishop, W. E. Cadd, Milton Markley, E. A. Condit, Jr., V. C. Armstrong, Thomas Ryan and G. H. Larson.

Railway Engineering and Maintenance, New York; copies of Railway Engineering and Maintenance and Railway Age; Elmer T. Howson, F. C. Koch, J. M. Rutherford, W. S. Lacher, G. E. Boyd, H. A. Morrison, W. N. Yadon, H. E. McCandless and J. P. O'Hern.

Railway Maintenance Corporation, Pittsburgh, Pa.; flange oiler, pictures of shoulder mole and six-foot ballast mole; J. B. McWilliams and J. F. Casey, Jr.

Railway Purchases and Stores, Chicago; copies of publication; Edward Wray, K. F. Sheeran, H. B. Kirkland and J. B. Murphy.

Railroad Supply Company, Chicago; tie plates; George T. Willard, John Hensel, E. H. Bell, R. E. Bell, H. M. Buck, W. S. Boyce and R. B. Archibald.

Ramapo-Ajax Corporation, Hilburn, N. Y.; automatic switch stand, double-shoulder switch plate, switch clip, manganese flange switch guard, adjustable switch brace, guard rail clamp, forged braces, rail expander and gearless switch stand, gage rods, double action oil dash pot, manganese articulated crossing and switch lock; T. A. Akers, W. Bender, G. M. Cooper, J. E. Davidson, D. Fairback, D. F. Hilton, P. Hoffman, J. V. Houston, John Hutchins, G. A. Carlson, R. W. Payne, J. B. Strong, J. V. Cowling, W. A. Peddle, H. W. Renick, W. J. Fairback and W. Perdue.

Reade Manufacturing Company, Jersey City, N. J.; moving picture showing application of chemical weed killer and miniature of spray equipment; R. W. Pritchard, B. S. Barnes and D. M. DeWitt.

Reliance Manufacturing Company, Massillon, Ohio; spring washers; Robert Shireman, H. R. Hanna, H. J. McGinn, E. D. Cowlin, H. P. McCormick, E. C. Gross and E. R. Howell.

Sellers Manufacturing Company, Chicago; wrought iron tie plates and wrought iron guard-rail tie plates; R. A. Van Houten, George M. Hogan and R. J. Platt.

Sinning Track Liner Company, Ramsey, Ill.; track liners and joint adjuster; F. R. Sinning, R. B. Hill, F. J. Reagan and Stanley H. Smith.

Skelton Shovel Company, Dunkirk, N. Y.; track shovels, spades and scoops; E. W. McCarty, H. C. Branahl and C. A. Trigg.

Standard Oil Company of Indiana, Chicago; asphalt and road oils, model of highway crossing, graphic chart of refining processes and literature; E. P. Keane, E. F. Tegtmeyer, F. G. Bowman and H. G. Van Velin.

Syntron Company, The, Pittsburgh, Pa.; electric tie tampers, portable electric rail drills, spike drivers, arc welders, electric nut tightener, portable saw, and scaling and chipping hammer; E. D. Jackson, D. G. Black and N. J. Ockereider.

Templeton, Kenly & Co., Ltd., Chicago; rail puller and expander, track jacks, bridge jacks, emergency jacks, screw jacks, pipe pushing jack and tie spacing shoes; George Mayer, C. A. Crane and W. B. Templeton.

Union Switch & Signal Company, Swissvale, Pa.; style T-10 hand operated switch mechanism; J. J. Cozzens.

United States Graphite Company, Saginaw, Mich.; graphite curve grease; O. R. Miller and N. B. McRee.

Verona Tool Works, Pittsburgh, Pa.; levels, gages, track tools, rail joint springs and rail anchors; A. C. Laessig, W. F. Schleiter, P. L. Laughlin and H. L. Paulson.

Warren Tool & Forge Company, Warren, Ohio; adzes, picks, spike mauls, sledges, hammers, track chisels, wrenches, gages and levels; Howard Mull, E. L. Ruby, J. A. Martin, R. E. Bell and J. F. Leonard.

Western Wheeled Scraper Company, Aurora, Ill.; working model of dump car and moving pictures and photographs; Jay Huber and Jesse Mossgrove.

Woodings Forge & Tool Company, Verona, Pa.; track tools, rail anchors and reformed angle bars; R. J. McComb, C. L. Woodings, Russell Wallace, E. C. Poehler, W. M. Westerman and B. B. Shaw.

Woolery Machine Company, Minneapolis, Minn.; tie scoring machine, motor car engine and photograph of weed burner, rail joint oiler, track bolt tightener and rail layer attachment; H. E. Woolery, C. E. Berg and Garrit Ye.

Non-Exhibiting Members

Air Reduction Sales Company, New York.

Balkwill Manganese Crossing Company, Cleveland, Ohio.

Chicago Pneumatic Tool Company, New York.

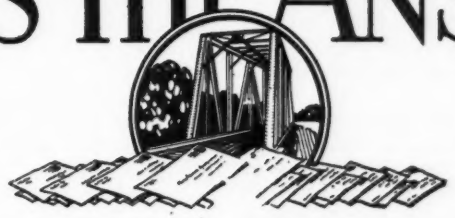
National Malleable & Steel Castings Company, Cleveland, Ohio.

St. Louis Frog & Switch Company, St. Louis, Mo.

Wm. Wharton, Jr. & Co., Inc., Easton, Pa.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?



Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE DECEMBER ISSUE

1. *When rail is being laid in the winter, what special precautions are necessary in addition to those required in the summer?*

2. *Where trouble is experienced with ice jams at bridges, what preparations, if any, can be made at this season to minimize the hazard later in the winter or spring?*

3. *What precautions, other than improved surface drainage, can be taken in the fall to prevent or minimize the heaving of track during the winter?*

4. *What is the best method of insuring that broken glass will be replaced promptly in engine house windows during the winter?*

5. *What are the causes of rail batter and what means, if any, can be employed to prevent it?*

6. *What precautions should be taken to insure the sanitary delivery of water to coaches and dining cars?*

7. *Is there any advantage in the preboring of ties? If so, what diameter of hole gives the most satisfactory result?*

8. *How should water barrels that are provided for fire protection on bridges, be prepared for the winter, and by whom?*

Discontinuing Tie Renewals

At what time should the renewal of ties be discontinued for the season? Is it permissible to renew considerable numbers of ties after this date, and if so, under what conditions?

Depends Largely on Climatic Conditions

By LEM ADAMS

General Supervisor Maintenance of Way, Union Pacific System, Omaha, Neb.

The time when the tie renewals should be discontinued for the season depends so largely upon climatic conditions that no definite date, applicable to the country as a whole, can be given. In the Northwest, we plan to have the bulk of our ties installed by the first of September, in order that we may have ample time to put our track in the best possible shape before freezing weather.

We usually find that, in doing this preparatory work for the winter, however, it is necessary to make occasional tie renewals. It is advisable to do as little of this work as possible late in the season, however, since a few ties not fully bedded before the track freezes are certain to create bad riding conditions during the winter months.

The ideal time for tie renewals is during the spring season, after the frost is out and the ground well settled, as this permits easy working of the ballast, and conditions are at their best for tamping the new ties that are installed. Ties installed at this period of the year are given ample time to become thoroughly bedded and any weak places that show up as a result of their installation can be taken care of by the track forces in sufficient time to insure good-riding winter track.

For these reasons, as much of the tie renewal program as possible should be completed by July 1, and no more ties should be put in the track after October 1, than are absolutely necessary. It is our opinion that emergency conditions would constitute the only justification for making tie renewals after the latter date in the northern sections of the country.

September 1 Should Be Deadline

By DIVISION ENGINEER

Under normal conditions of maintenance, which include an adequate supply of ties to meet the requirements of the season's program, the earlier the ties are installed, the more certain will it be that the riding conditions of the track will prove satisfactory during the succeeding winter. For the railway as a whole, the time when this can be accomplished can be estimated with considerable certainty. For a given section or even a district this date may vary somewhat, depending on the condition of the track, the number of ties required, the rail laying program, the amount of ballast that is to be renewed, and the labor-saving equipment available.

As soon as the frost leaves the ground, the section forces should go over the track, smoothing it up and putting it in such shape that, by the time it is well settled, it is in condition to allow them to devote their efforts to tie renewals. From this time, major attention should be given to this feature of the season's program, with the purpose of completing it by July 1, or as soon thereafter as possible. On many sections this can not be done, however, for various reasons, but in every case September 1 should be set as the deadline, and the work of general tie renewals should not be permitted to be continued beyond this date.

In case any section falls behind schedule on its tie program, so that the work cannot be completed on time,

a situation which is likely to occur occasionally, the supervisor should take whatever measures are necessary to speed up the work, giving this section preference in the distribution of ties, relieving the gang from other work that may be interfering with its schedule, providing extra forces or resorting to any other action which may be necessary to complete the tie renewals on the date which has been set.

Should considerable numbers of ties be renewed after this date? The answer is an emphatic no. It is recognized as fundamental that when ties are inserted in the track they require considerable time to get well settled on their beds, and that until they do, the riding qualities of the track are somewhat impaired. If the renewals are made late in the season, sufficient time is not allowed before winter conditions prohibit surfacing, for the ties to get a firm bearing. The result is that the track stays rough through the winter, the gage and line may be affected and the track emerges in the spring in poorer condition that it should, thus necessitating extra work at the time, in the spring, when the track forces should be getting ready for the season's program, besides which it has been a subject of criticism for several months.

The writer knows of only one condition which would justify the installation of a large number of ties later than the date indicated. This is some emergency, which cannot be foreseen, and which must be taken into account as it arises. Any other situation which requires the late renewal of a large number of ties must have as its background some form of mismanagement on the part of the maintenance forces themselves, or elsewhere in the organization, that is responsible for the necessary supplies or the allotment of funds to carry on the work.

How to Splice Piles

When necessary to splice piles, how should this be done to obtain the best results?

Favors Butt Splice Held in Place by Scabs

By Frank O. Draper
Superintendent of Bridges, Illinois Central, Chicago

When it becomes necessary to splice piles, our practice is to use a butt splice with four scabs tightly bolted to the pile both above and below the joint. In doing this, just enough of the circumference of the pile is cut away to insure a good bearing of the splice timber against the stick. The standard from which we work requires the clamping timbers to be 6 ft. long and 3 in. by 8 in. in section. Six bolts, ¾ in. in diameter, pass through each pair of these timbers and the pile itself, three above and three below the joint. Large machine washers are used under the head of the bolt and under the nut, to enable the bolts to be drawn tight with a minimum of compression in the wood fiber, thus insuring that the splice will have little, if any, play during driving.

This form of splice has been standard on our road for many years and has proved satisfactory under all forms of driving where splicing is required. In fact it seems to be the only form of splice that is dependable with the treated piles we commonly use, since they are made from the softer woods.

We have never tried to drive piles with a long spliced joint, since the type of splice we are using has been satisfactory under the conditions which we encounter. Years ago, in the swamp around the shore of Lake Pontchartrain, through which the railway runs for a number of miles north of New Orleans, and where long piles are required to secure an adequate bearing for the pile trestles which are used, the piles were spliced by merely cutting the abutting ends off square, setting one pile on top of the other and holding them together by means of a dowel. This did not give good results, since many of the piles bent at the splice or slipped apart, as is evidenced by the fact that many of these bridges have settled on one side.

For the reasons given, we believe the type of splice which has been described will give the best results under practically all conditions.

Two Methods Are Recommended

By Master Carpenter

In railway work, two methods of splicing piles have been used with excellent results. The form of splice which has the widest use, and which probably can be considered to be best adapted for use under all forms of driving, is the butt splice with long splicing timbers. One of the advantages which it possesses is that it can be made quickly in the field by the pile driving crew, without the use of special tools.

In selecting piles for splicing it is desirable to select those that have nearly equal diameters and the least taper, so that the difference between the diameters at the adjacent tips and butts will be a minimum. If this is done, it becomes unnecessary to cut away so much of the section of the lower pile for the purpose of fitting the splicing timbers, as would be required otherwise.

While the splicing timbers, or scabs as they are generally called, must be of sufficient thickness to hold the two sections of the pile in alinement during the process of driving, they must not be so thick as to increase the difficulty of driving. Not infrequently, where this precaution is neglected, the resistance to driving is increased to the extent that the pile is damaged by the action of the hammer or the scab timbers are split and destroyed. In either event, the pile may become entirely useless and cannot be withdrawn, so that it interferes with the driving of another pile to replace it. The length of the scabs is also important. Sufficient length should be provided to give maximum rigidity to the splice, since, if this is not done, buckling may occur at the joint, particularly if some obstruction tends to deflect the pile.

In general, splicing timbers 3 in. by 8 in. in section are considered most satisfactory, although, when driving in soft material, this section may be reduced at times without danger. In fitting them, no material should be cut away from the two sections of the pile, other than that required to give a full bearing. Scabs should be approximately six feet long to develop the greatest strength at the joint, and should be applied in pairs directly opposite each other. Two pairs are usually sufficient, although three may be required in extreme cases. This length gives ample room to apply three bolts in each pair of timbers on either side of the joint, with sufficient spacing to avoid weakening the pile itself. They should be applied with large diameter washers to reduce the unit pressure on the wood fiber when they are drawn tight, and thus insure that the bolts will not become loose during the process of driving, through crushing of the wood, especially if the pile should be deflected. In order to reduce the resistance to driving, the bottom ends of the scab timbers should be given a long bevel, while a shorter bevel can be given at the top.

Pile driving gangs should be supplied with a sufficient stock of splicing timbers already framed and bored, and several lengths of bolts, so that when splicing becomes necessary the piles can be framed with an adze and

an auger and the scabs applied quickly, thus saving considerable time.

The other form of splice, which frequently has been used with good results, also consists of a butt joint. In this case, however, the method of joining the two sections of the pile is somewhat different, a sleeve being used instead of the bolted timbers already described. This sleeve can be made from wrought iron or steel pipe which has been discarded by the water service department, 8-in. pipe being the most common size required, although occasionally the 6-in. and 10-in. sizes may be necessary.

The length need not be so great as is required with the scabs, 18 in. to 4 ft. being sufficient. In using this form of connection, the lower pile is trimmed to a diameter slightly in excess of that of the pipe, which is placed on top of the pile and given a light blow with the pile hammer to seat it. This will give a tight fit. The upper section of the pile is then placed on the pipe and another light blow given. If the piles have been selected carefully, both sections will fit tightly in the pipe and a rigid joint will result. As an extra precaution, holes should be bored at the proper points in the pipe before it is applied, and boat spikes or short drift bolts driven into the timber to prevent possible movement during driving. This form of joint gives a smoother surface with less resistance to driving and, if the piles are selected with care, a very rigid connection.

Cleaning Side Ditches

When should the work of cleaning out side ditches and shaping them for winter be started? What is the best method of doing this work?

Hand Labor Is Out of Date

By P. J. McAndrews

Roadmaster, Chicago & North Western, Sterling, Ill.

The use of hand labor in ditching is completely out of date. In recent years the development and use of machines, designed especially for cleaning out and shaping up side ditches have entirely displaced the former uneconomical method of ditching by hand. For this reason, the time of doing this work varies somewhat from the former practice, which was followed by most maintenance forces, of having the ditches cleaned out and shaped up late in the fall, sometimes after the ground was partly frozen.

As a result of the introduction of ditching machines, the importance of keeping them working throughout the season has developed new practices, and it has been found that the type of work in question can be done any time after the frost has left the ground in the spring and the usual settlement of the earth has taken place. In some cases, where the ditches have been cleaned out early in the year and vegetation has secured a foothold, it is desirable to go over the ditches late in the fall to put them in final shape for the winter. In other cases, especially where heavy rains have not occurred to wash material back into the ditches or where the slopes are well sodded, a single cleaning, even when done early in the year, is all that is necessary.

When cuts have been widened properly and adequate subdrainage provided for the roadbed, a vital feature in track maintenance, the cleaning of the ditches may be done at any time between May 1 and October 30, in the northern and central states, with the possibility that some further attention may be necessary if there have been heavy rains. The cleaning and shaping of the ditches should never be deferred, however, until so late in the season that the ditch will not function properly during the period of fall rains when track drainage is so essential to good winter track.

As already stated, the hand method of cleaning and shaping ditches is practically obsolete. Several types of satisfactory machines are available for the purpose of widening cuts or cleaning out badly fouled ditches, after which other machines are also available to shape them up to the railway's standard section and remove any excess earth from the cut, giving ample room for an adequate ditch. For this latter operation excellent combination spreader-ditchers are available, and except to take care of work at bridge ends, highways or roadside obstructions, hand labor is rarely necessary.

Machines Are Speedy and Economical

By G. Stafford

Section Foreman, Canadian National, Rosebud, Alta.

The quick and efficient removal of water from the roadbed is a matter of vital importance. The cleaning and improvement of the side ditches where necessary and, in fact, attention to the whole drainage system should occupy a prominent place in the working program of the section. As an illustration, I will cite my own section. There are no conditions which create unusual maintenance difficulties; yet for the present working season an analysis of the labor applied to all of the work done to date, in terms of man-days, with a total of 687 man-days, shows 508 man-days, or practically 74 per cent of the total, have been expended on maintenance work which can be attributed primarily to conditions that result from imperfect or inadequate drainage.

Immediately after the tie renewal and surfacing program is completed, ditching should be undertaken. No set date can be laid down for commencing this part of the program, since it is dependent upon whether the section work has been maintained to schedule. A month before the advent of the winter or the rainy season is the latest date, however, that this work should be taken in hand.

In this territory a spreader ditcher is usually operated over the subdivision during the month of August, cleaning and shaping ditches to our standard section in cuts and on low embankments where the fill is not sufficient to provide natural drainage. It then remains for the local section forces to co-ordinate and supplement the work of this unit. It is necessary, in places, to skip certain stretches, owing to obstacles, such as bridges, highway crossings, etc. Here the work of widening and deepening must be performed by hand. Inlets and outlets of drain boxes under crossings, particularly those which affect the flow of water in side ditches, are cleaned at this time and obstacles removed to allow free passage of the water. Where practicable, in the longer cuts, ditches are provided with outlets at frequent intervals to avoid running water long distances, with the probability that their capacity will be exceeded. As a part of this work, ditches which approach bridge-ends, or which show evidence of scouring, are protected by blind drains. Drainage must be afforded for all wire and pipe connections at interlocking plants, this usually being accomplished by means of adequate side ditches. It is important that surface drainage in yards and in the vicinity of stations should receive attention at this time. Stagnant water between tracks is unsightly, affects track conditions and constitutes a nuisance to both employees and the public. Where sliding banks tend to fill the side ditches or otherwise block the flow of water, drainage ditches should be dug along the top of the

bank to receive the surface water and prevent it from washing down the slope. These drains should be continued down the slope at the end of the cut and discharge by way of the natural water courses.

As to the best method of doing the work, the spreader-ditcher is a labor-saving device which, in the hands of a capable operator, will perform a thorough and uniform job of cleaning the side ditches, reducing the cost and the time required to do the work to a small fraction of that required for hand work. On the other hand, haphazard or indifferent operation results in badly graded ditches, containing series of water pockets, and subsoil material is deposited on the ballast shoulder, fouling the drainage through the ballast. The day is past when any railway can afford to rely on hand labor for any form of ditching which can be done by machine equipment, and the spreader-ditcher is a machine that is adapted particularly to the work of cleaning out and shaping up side ditches.

Condensation from Skylights

What measures, if any, can be taken to prevent or minimize the condensation of moisture and dripping from skylights?

Provide Troughs to Catch the Moisture

By B. P. Phelps

Engineer Shop Extensions, Atchison, Topeka & Santa Fe, Topeka, Kan.

I do not know of any way in which skylights can be insulated, as is done with other parts of the roof by means of roof coverings. If the outside air is cold, and the air inside the building is moist and warm, condensation will accumulate on the skylight. Since this is the result of a natural law, it cannot be averted.

The dripping can be minimized, however, by constructing the skylights in such manner that the glass surfaces are tilted from a horizontal plane, so that the moisture can be collected at the lower edges. If this arrangement of the skylights is followed, suitable troughs can be provided to lead the moisture to some receptacle or to a drain. On the Santa Fe we have secured excellent results from skylights installed in the shape of an A, when placed on flat roofs and equipped, as described, with facilities for drainage.

Condensation Can Be Minimized, Not Prevented

By Engineer of Buildings

The only reason for installing skylights is to improve the day lighting of those structures to which they are applied. Since this is so, and since no form of insulation is known which will perform the dual function of admitting light and eliminating heat transference, the condensation of moisture upon the interior surface of skylights cannot be prevented, when the outside temperature is considerably below that in the building.

The amount of moisture which collects on these surfaces, however, is a function of the difference between the outside and inside temperatures and of the degree of humidity of the air in the building, so that the amount of condensation can often be controlled by a proper system of ventilation or by air conditioning. While either of these methods frequently gives satisfactory results in certain classes of buildings, such as offices, stations, storehouses, and some types of shops, they are not adapted to other classes of buildings, or the cost of installation may be too high for the results that can be attained.

In stations and offices, the insertion of ceiling lights below the skylights may practically eliminate the trouble experienced from condensation, if either the circulation or the changing of the air between the ceiling and the roof can be prevented, so as to keep the humidity of the air in this space low. Where ceiling lights are not practicable and the area of the skylights is not too great, the inconvenience which results from the dripping of the condensation can often be wholly or nearly eliminated by a rapid circulation of air against the glass surfaces. This can be accomplished by means of an electric fan, by directing one or more outlets from the ventilating fans against the skylight, or, possibly, by installing a unit heater to produce the same result. Everyone is familiar with the practice of placing an electric fan in a show window to prevent condensation and the accumulation of frost on the glass. The same results can be obtained for skylights, provided the area is not so great as to make the installation impracticable.

Where none of these methods is feasible, the satisfactory disposal of the condensation becomes a matter of prime necessity, especially if the low outside temperature is long continued or the humidity in the building is high. In these events only one method has been found practicable. This is to install the glass surface of the skylight at such an angle with the horizontal that the condensation will not drip directly from the glass at the point where it accumulates, but will run down and collect at the lower edge of the skylight where it will drip into troughs which are installed for this purpose and which have sufficient capacity to hold the maximum accumulation or will drain it to a receptacle or to the sewer.

Inspecting Ties for Removal

When inspection is made in the fall for next season's tie renewals, how can one determine what ties should be renewed, particularly where a large number of the ties already in the track are treated?

Condition Can Usually Be Determined Easily

By J. Morgan

Supervisor, Central of Georgia, Leeds, Ala.

This is and should be a matter upon which great stress should be laid, since both safety and the good riding qualities of the track are involved. Yet the inspector should be very careful to see that he is not wasteful with ties, since both the conservation of materials and unnecessary costs are involved. Any man experienced in the inspection of ties to be removed from the track can detect readily those defects in untreated timber which render it unfit for further service. The inspection of untreated ties to determine whether they shall be removed requires considerable skill which can come only from experience. Where the ballast comes to the tops of the ties, it is customary with us to use the back of an adze or other small, blunt instrument to tap on a tie that appears to be unfit to remain in the track, provided there are no defects which are open to view.

In determining whether a tie is to be removed from the track, we are governed in part by the amount of mechanical wear which has taken place, particularly in soft-wood ties. Where we have soft-wood treated ties, we rarely find defects which require their removal except those which result from mechanical wear. On heavy curves, however, there is a noticeable tendency for the soft-wood ties to crush at the ends, particularly on the inside of the curve. This condition, of course, renders them unfit for further use and we have been

compelled to remove a considerable number of ties from this cause. It has been our experience that where excessive mechanical wear occurs in treated ties, the wood under the tie plate is quite soft for a considerable depth and that it is possible, in many instances, to gouge out as much as an inch or more of soft or mashed-up wood pulp. This condition occurs most frequently in treated pine ties but we have found the same condition in treated oak. We have used treated ties on this road for about 16 years and have been compelled to remove few, if any, of these ties on account of decay. Practically all the ties removed have been removed because of excessive mechanical wear. With us treated ties which must be removed from the track because of decay can usually be determined by tapping them with a blunt instrument.

Fall Inspection Is Not Recommended

By I. H. SCHRAM

Engineer Maintenance of Way, Erie, Hornell, N. Y.

The practice of making a tie inspection in the fall for the next season's renewals has been very largely abandoned on many lines, particularly on heavy traffic stone ballasted tracks, in which the majority of the ties are treated. An inspection of the kind mentioned is of little use. It is no better than an estimate and, if proper programs for other work have been made over a period of several years, an estimate will be closer than an actual inspection.

The practice of digging in ties on stone ballasted track has been abandoned on a large number of railroads. It tends to soften and make uneven the bed of otherwise good track and it is for such work that tie spotting is largely used.

The best practice is to limit tie renewals as closely as possible to points where track is being ballasted with stone or being reballasted, at which time tie conditions should be made good enough so that track will not have to be disturbed for a designated number of years. Under such conditions and with the large number of ties in the track, which are treated and protected with tie plates, the tie renewals can be estimated very closely from a knowledge of the character of the track and tie conditions and from previous ballast work of the same character. Such estimates, in my estimation, are more liable to give a better idea of what is actually required than the spotting of individual ties.

No Difficulty in Determining Condition

By BERNARD BLUM

Chief Engineer, Northern Pacific, St. Paul, Minn.

This question may have arisen from the fact that good treated ties on either side of a poor tie will allow the poor tie to remain in the track for a longer period than would be considered permissible if the sound ties were not there. On the other hand, this question may have been prompted by the fact that the person who originated it was not able to discern by inspection whether a treated tie had reached the end of its life.

On the basis of the first supposition, it is my opinion that ties should be renewed when their condition is such that they do not adequately support the rail and distribute the load to the ballast for the class of traffic operated over the line. In other words, the fact that the adjoining ties are sound should not cause one to leave in track a tie that has clearly outlived its usefulness.

The number of ties to be ordered for the next season's renewals can generally be determined by a surface inspection, supported by tamping the tops of the ties with a maul or other blunt instrument.

If the difficulty arises from the fact that the questionable ties are treated, it is probable that the ties are still in good condition. If the treated tie should be decayed below the surface, usually such a condition is discernible by the indentation of the tie plate, but if this is not sufficient the condition of the tie usually becomes apparent at once when it is tapped as suggested.

Burning the Right of Way

What are the advantages of burning the right of way, and what special precautions, if any, should be taken during the fall months to prevent grass fires from spreading to adjacent property?

Avoids Fires Spreading and Improves Appearance

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

In the south we watch the points where fires on the right of way would be likely to spread to adjoining property, and just as soon as the vegetation is dry enough we burn the right of way to prevent the danger of damage to other property by fire. In some cases, where the grass or other growth is so dense as to make it undesirable for our forces to take any chance of the fire getting away from them, we plow a few furrows on the outer line of the right of way or on the adjacent property if we can secure permission to do so. This insures almost complete protection against the spreading of the fire to adjacent property or the probability that the fire will get out of control, since it will be confined to a definite area on the right of way.

We also have another practice in which we require the foremen to fire according to the direction of the wind, starting the fire so that it will burn against, rather than with the wind. Rigid instructions are also in effect that in no case shall a fire be started where it would likely spread to private property if the wind is blowing toward it, but that in all such cases it shall be set when the wind is blowing toward the track and the fire must be started at the track and allowed to burn away from it. If this practice is maintained, there will be little chance of the fire spreading. We have found by experience that ordinarily the wind changes direction a sufficient number of times during a week to enable the foreman to cover his section in this time, even where the alinement is quite crooked.

In the south, the advantage in burning the right of way is primarily to reduce the fire hazard, but it is also done to maintain a clean open space on which the track is located, in order to present a neat appearing right of way to the public.

Burning Reduces the Fire Hazard

By GEORGE M. O'ROURKE

District Engineer, Illinois Central, Waterloo, Ia.

Whether the right of way is mowed before burning depends upon the importance of the railroad, its location, and the climatic conditions. In some localities the growth becomes so heavy that an annual cutting is necessary. Usually, in such places, there is no killing frost and the vegetation must be cut and dried before it will burn.

Where the winters are severe and the growth of heavy underbrush is slow, there is no real necessity for cutting weeds except along the track, to keep the ballast

clean; at road crossings to improve the view; around signs and mile posts for the same reason; in the vicinity of inflammable structures; and to keep noxious weeds from spreading to adjacent farm lands. In such places, if the weather is dry in the fall of the year, the right of way can be burned clean after a killing frost. If the weather is wet, the vegetation probably will not burn until early spring. Where heavy weeds which have not been cut are encountered, the stalks left standing after they are burned over can be knocked down easily without any great expense.

The advantages to be gained through these annual burnings are:

Maintaining the appearance of the property;
Stunting the growth of vegetation, which becomes heavier each year if not burned;
Eradicating some tender growths completely;
Quickening of the drainage and the drying out of the roadbed;
Reduction of the fire hazard;
Securing the good will of farmers and owners of adjacent property;
Destruction of various weeds.

In preparing to burn the right of way, fire guards should be plowed along the fence line, either on the railroad property or just off it on adjacent property. All vegetation should be shovel cut down to the soil, around all inflammable structures and storage piles of ties or other materials.

Where it is possible to avoid mowing the right of way, a considerable sum can be saved each year by burning immediately after a killing frost in early winter. Whether the right of way is burned in this manner or cut and permitted to dry before burning, it should be burned every year.

Keeping Sludge Drains Open

What special precautions, if any, should be taken to insure that the drainage of sludge from a treating plant will be maintained during the winter?

Keep the Outlet Clear

By Supervisor of Water Service

If the sludge drain has been constructed with a uniform grade line and has been placed below the frost line and, further, if adequate provision has been made for the disposal of the sludge beyond the outfall, the drain itself should give little more trouble in the winter than in the summer.

Conditions sometimes occur, however, where the provisions for disposing of the sludge beyond the mouth of the drain are inadequate. In such situations considerable trouble may be experienced during the winter with clogged drains unless measures are taken to insure that a clear outlet is provided. The manner in which this shall be done must be determined locally after a consideration of the means available for correcting the condition.

The writer recalls one instance where a sludge pit had been provided by constructing a dam across a small draw, for the purpose of preventing the flow of sludge into an adjacent stream. The accumulation of sludge eventually filled the pit and blocked the outlet. The local supervisor of water service made a canvass of the farmers in the vicinity and found that they would be glad to haul the sludge away and spread it on their land. In this way the entire accumulation was removed at no cost to the railway and the capacity of the pit was restored sufficiently to hold several years' accumulation of sludge.

If the sludge drains have been constructed properly and there is sufficient outfall, no special difficulty should be experienced in the disposal of the sludge during the winter. Frequent inspection should be made of the outlet, however, and, if there is a tendency toward the building up of an accumulation of frozen sludge during periods of low temperature, the outlet should be kept clear, so that it will not become clogged and the sludge permitted to accumulate in the drain. It is often extremely difficult to wash out a drain in which settlement of this character has taken place, and sometimes the only remedy is to abandon the drain entirely or take it up and relay it after the individual sections have been cleaned.

Tanks Should Be Protected from Freezing

By C. R. Knowles

Superintendent of Water Service, Illinois Central, Chicago

So far as the drainage system itself is concerned there should be little trouble in maintaining proper sludge drainage from treating plants. Of course, this statement is based on the assumption that the drainage system is correctly designed.

Care should be taken to avoid sags or pockets in drainage lines, as ice is liable to form in these pockets, especially where the outlet is in an exposed position or where the line is not buried below the frost line.

The most important feature of this problem is the freezing of sludge in the treating tank. This is true particularly of flat bottom tanks constructed of either steel or wood, although the sludge will freeze more readily in a steel tank than in a wooden tank. Modern sludging systems within the tanks have been designed to avoid the accumulation of sludge in the tank from either freezing or other causes. Yet, no matter how carefully it may be designed, the sludging system requires proper attention and regular operation.

Conical bottom tanks and conical bottom tanks with mud drums offer less of a problem from frozen sludge than the flat bottom tank, but, at the same time, regular operation of the sludge valve is necessary to avoid the sludge freezing in the mud drums. Where very severe winter conditions prevail, it may be advisable to construct frost boxes around drums, and in some cases the entire tank may need to be enclosed. As a rule, the protection of sludge systems and drainage against freezing necessitates the same precautions that would be followed in regular water station operation.

The Annual Bridge Inspection

When should the annual bridge inspection be made, what items should it cover, who should compose the inspection party and what records should be kept?

Every Officer Interested Should Be in the Party

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

The system of bridge inspection in effect on the different railroads varies considerably, because of differences in the lengths of their lines, in their maintenance organizations, etc.

I think that it is important that bridges be inspected more frequently than once a year. On important lines they should be inspected once every month by the foreman on the territory of which he has charge, or by a regularly assigned inspector. I have always favored having the foreman make these inspections, because he is responsible for the safety of the bridges and by doing this there is no chance for division of responsibility. Twice every year an inspection should be made by the local supervisor of bridges or master carpenter. He

usually has about 500 miles of territory assigned to him. On this inspection he should be accompanied by the local bridge foreman. The results of this inspection should be transmitted to the division superintendent, the bridge engineer, the engineer of maintenance, or other officers, depending upon the organization. The record of the inspection should be kept in a note book designed for the purpose for a permanent record, but in transmitting this information the bridges should be marked "O. K." or points requiring attention should be noted, in accordance with the conditions which were found to exist.

In addition to these inspections an annual inspection should be made, particularly of the steel structures, by a man with technical training, preferably the bridge engineer or someone from his staff. He should be accompanied by the local supervisor of bridges or master carpenter, by the division engineer, and the engineer of maintenance, by such operating officers as can conveniently come along and by an assistant who can help in making the inspection, keep records, etc. In addition to making an inspection of steel structures an inspection should be made of all other bridges which may require replacement during the following year. For this purpose it is best to make the annual inspection in the fall after the bulk of the season's work is completed, but early enough so that the budget for the following year can be prepared from the information obtained.

When considering the character of the openings to be put in during the following year, it is advisable to have local employees, who have been in service on the territory a considerable time, accompany the party and give the benefit of their experience as to proper size of openings, and any other pertinent information they may possess.

In making the inspection of steel bridges, the substructure, whether composed of masonry, concrete or timber, should be examined for defects. The condition of the paint on the superstructure and the condition of the timber in the deck, if any, should also be noted. An important thing to examine is the provision for expansion. This should be free, and the anchor bolts or roller nests should not restrict the expansion of the span. In case the foundation has moved slightly, it may be necessary to chip the parapet wall of the abutments, lengthen the anchor bolt slots, reset the rollers or arrange for shims. In a pin-connected structure, pins should be examined to see if the nuts are working loose and all of the bars should be tested to determine whether they are in good adjustment. The camber of the bridges should also be noted. The lateral system should be tested to see if there are any loose members or loose rivets. Riveted stringer and floorbeam connections should be examined for loose rivets and for cracked connecting angles. Where excessive corrosion has taken place due to brine action or other causes, the extent should be noted, and if necessary a special inspection should be made when more time is available by someone who can measure the remaining sections accurately.

General track conditions, such as the alinement and surface of the track, should be noted, also the condition of the running rail and fastenings. It is not unusual to find cracked angle bars on bridges and in some cases excessive corrosion of the track spikes will be noted. On ballasted deck bridges the condition of the ballast and of the drainage openings should be noted. It is important to keep the drainage openings free for the discharge of water to avoid puddled ballast.

In the inspection of the timber bridges, free use should be made of a pointed bar for testing the piling and timber. The point where the piling usually gives trouble is at or just below the ground line, while the timber is liable to get soft first at the bearings. It is desirable to keep the rot trimmed off the piling so that the extent of the remaining sound section can be noted. It is difficult to lay down rules which will govern in determining whether or not a wooden bridge should be rebuilt. This depends largely on the character of traffic and the strength of timber and piling required. In general any piling having less than six inches in diameter of sound timber should be replaced with a post or helper pile.

Different roads have different systems of keeping the report of this annual inspection; usually it is sufficient to give the number and general description of the structure with a record of the date of construction of the superstructure and substructure, the date when last painted, the date when the deck was renewed, and the general condition. This should be followed by recommendations for work during the following year. This report is sent out to those in charge of the maintenance work.

A Detailed Record Should Be Kept

By Roy Hahn
Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

While it is important that an annual inspection of bridges be made, it is equally important that two other thorough inspections be made every year in order that more frequent information shall be available as to the condition of the bridges and to keep the lists of material needed up to date.

The annual inspection should be made in the fall. At the time of this inspection a record should be made for each structure, in which should be shown the bridge number, the type of structure and the length, indicating whether there are approaches and, if so, the type. If there is a draw span the record should indicate the type and length. The height and condition of the ground surface should be recorded. This information will be needed later in preparing completion reports where work which includes capital charges has been necessary. In addition, the date of the inspection should be recorded.

After this preliminary information has been recorded, notes should be made in detail of the condition of the structure, as determined by the inspection, and the materials which will be necessary to make such repairs as are required to bring the several parts of the bridge into first class shape. When it is found necessary to renew any structure, or where extensive repairs are deemed necessary, investigation should be made to determine whether the opening can be reduced by filling, and if so, what size and type of opening can be substituted.

Immediately after the inspection is completed, or as soon as the notes can be shaped up for this purpose, requisitions should be prepared and forwarded, covering the materials needed. This should be shipped to the most convenient points not later than January 1, in order that there shall be no delay in starting on the annual bridge repair program, and to avoid the necessity of the gangs doubling over the road as a result of lack of material for particular jobs.

The annual inspection party should be composed of the general bridge inspector or, in his absence, the division engineer, and the master carpenter. It is advisable for the division engineer to make the inspection, however, in order that he may familiarize himself with the conditions as they exist at the time of the inspection.

New And Improved Devices

A Safety Motor Car Coupler

FAIRMONT Railway Motors, Inc., of Fairmont, Minn., have placed on the market a new coupler for motor cars which cannot be unhooked, except deliberately by hand. This device, known as the

Fairmont Safety Motor Car Coupler

M11668 Safety Coupler, consists of a standard hook made from a ¾-in. steel rod, secured by a malleable iron latch, hinged on a steel butt welded to the rod. The hook fits the coupler hole in standard motor car, trailer and push car drawbars used on Fairmont cars.

Stonhard for Patching or Resurfacing Concrete

IN ORDER to obviate the necessity of chipping out old material in concrete or mastic platforms when making repairs, to avoid feather edges of the new material, the Stonhard Company, Philadelphia, Pa., has improved its Stonhard resurfacer and also the methods of mixing and applying. It is said that this material will take a permanent bond with old surfaces of concrete, brick, wooden blocks or asphalt, and that it furnishes a surface which is resilient, durable, waterproof and dustproof, not only for floors, platforms and runways, but also for vertical surfaces, as in retaining walls, bridge piers and abutments.

Station Platform on Chicago & North Western Repaired with Stonhard Resurfacer

This surfacer, which is said to be in use on 45 railways, is of the consistency of putty, and is prepared for use by mixing with sand, cement and water to form a rich mortar. When used for repairing or resurfacing, the only preparation necessary is to see that the surface to which the Stonhard is to be applied is free from dust, dirt or grease, after which the mortar is troweled into place and allowed to harden. It is said that the surface obtained can be varied from one having the characteristics of mastic to those having the hardness of concrete, thus making it available for a wide range of uses.

An Ingenious Application of a Tie Tamper Outfit

A SUPERVISOR who had a six-tool Syntron tie-tamping outfit of the power-car type was confronted early this season with the necessity of surfacing a number of paved road crossings, which were located at widely separated points. He had no paving-buster equipment available, but had his blacksmith straighten out two worn tamping bars and

Busting Pavement with a Syntron Tie Tamper

sharpen them to a chisel edge. Thus equipped, he was able to tear out the paved road crossing at the rate of two square feet a minute. As soon as space permitted, the other four tampers followed up, tamping the track to the proper surface.

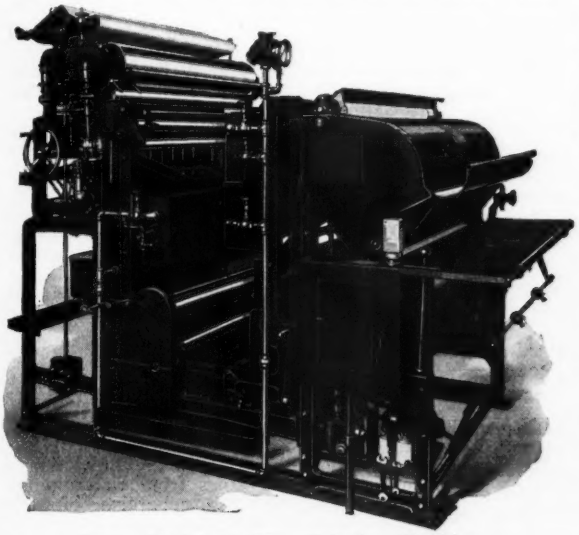
The results on the first crossing proved so satisfactory that he sent the outfit over his entire district, under its own power, to perform the same work. The power car was also supplied with an electric rail drill, which was used at the same time to drill

the new guard rails, which were installed in all of these crossings.

The application of the Syntron equipment to this type of work was so successful that other supervisors on this road are being instructed to use their equipment for a like purpose. The change-over is made at no expense after the tamping bars are prepared, since all that is necessary to do is to change the tamping bars in the guns, replacing them with the shapened tool, when ready to begin the work. The straightening of a worn bar and sharpening it to a wide chisel face for paving-buster work can also be done at a nominal cost.

New Blue-Printing Machine Operates at Higher Speed

GREATER speed of production, high quality prints, flexibility of operation and low operating cost are prominent features claimed for the new Pease "Peerless" Model "30" blue printing equipment of the C. F. Pease Company, Chicago. In developing this model, radical changes are said to have been made in the design of the present model "20," although the operation of the two machines is quite similar.



Pease Model 30 Blue Printing Machine

Following the usual practice in making blue prints, tracings are laid face-up on a continuous roll of paper, feeding at the front of the machine, and are carried upward around a semi-circular, uniformly curved segment of French plate glass, past a bank of arc lights having a high actinic value. After exposure, the tracings are returned automatically into a tray at the front of the machine, while the continuously printed roll is carried through the machine and the subsequent operations of washing, potashing and drying are performed automatically in succession. When dried, the paper is also rolled automatically in a loose cylinder convenient for cutting and trimming. During the entire travel, the roll of paper is driven by means of gears, without drag or danger of strain or breakage.

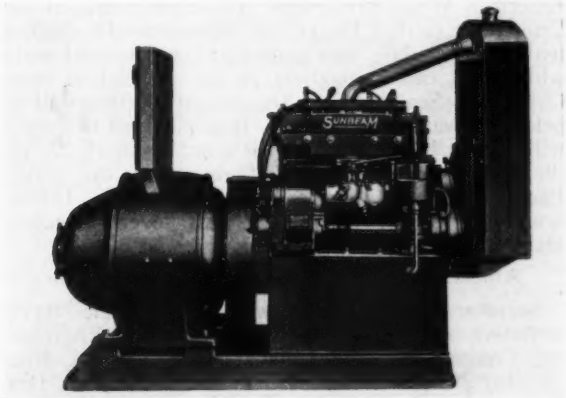
The machine is direct gear driven throughout by means of a ¼-hp. motor and can be adjusted instantly to any speed between 4 and 12 ft. per minute. A special four-point auto-type gear shift at the left of the feed table provides for two forward speeds, high and low, and neutral and reverse, the latter being an entirely new feature, which enables the operator to withdraw tracings or run back the leader roll, when desired, without inconvenience or delay.

After the prints are developed and washed, they are given a final, thorough cleansing by means of a finely divided spray under heavy pressure. They are then carried over the dryer, which consists of two chromium-plated copper drums, which are provided with a graduated heat arrangement that is said to insure smooth, unwrinkled prints.

In the event that only a few prints are required or it is desired to operate the machine intermittently, the Model "30" can be operated independently of the washing and drying unit, by means of a simple clutch arrangement, and it can be purchased separately if desired.

New Line of Gas Electric Plants

THE Sunbeam Electric Company, Evansville, Ind., has developed a new series of portable power units, comprising electric generators of from 1½ to 5 kw. capacity driven by four-cylinder gasoline engines. These are designed for any class of service within their rated capacity, where central station power is not available, being adapted especially to supplying current for electric lights in camps, on construction work, etc., or for providing the power for the operation of electric tools of various kinds.



The Sunbeam Gas-Electric Plant

The engine has cylinders with a 2½-in. bore and a 3½-in. stroke and a balanced crank-shaft 1¾-in. in diameter. It is water cooled with a radiator and fan and thermo-siphon system. The radiator is of tubular cone construction. A full pressure oiling system is provided, in which the cam shaft is submerged in oil so that tappet and cam noises are eliminated. All parts are easy of access.

The generators are available in four sizes, 1½, 2½, 4 and 5 kw., delivering direct current at either 32 or 110 volts. Sunbeam plants can also be supplied to deliver alternating current. These machines are said to produce current at practically uniform voltage under all load conditions.

The plants are all provided with storage batteries so that constant operation is not necessary to take care of periods of small or intermittent current demand. The 32-volt battery is furnished with 16 cells and the 110-volt with 56 cells.

WITH THE ASSOCIATIONS

Maintenance of Way Club of Chicago

The ninth annual dinner of the Maintenance of Way Club of Chicago will be held at the Auditorium hotel on Tuesday evening, October 22. W. E. Fuller, assistant to the executive vice-president of the Chicago, Burlington & Quincy will be the speaker of the evening, his subject being "The Roadmaster in His Relation to the Superintendent."

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held at the regular meeting place of the club, Keen's Chop House, 72 West 36th street, New York, on the evening of October 18. Dinner, which will precede the business meeting, will be served at 6 p. m. (D. S. T.). The speaker at the meeting will be Earl Stimson, chief engineer maintenance, Baltimore & Ohio, who will discuss "Economies in the Use of Materials."

American Wood-Preservers' Association

At a meeting of the executive committee of the American Wood-Preservers' Association held at the University Club, Chicago, on September 13, 1929, a tentative schedule was approved for a special train which will carry members of the association from Chicago to Seattle where the annual meeting will be held on January 28-30, 1930. It is expected this train will leave Chicago about 8:30 a. m., January 23, via the Chicago, Burlington & Quincy and the Union Pacific, making a number of stops enroute. Invitations have been received to visit several treating plants and lumber mills.

American Railway Engineering Association

Secretary E. H. Fritch, who is the official representative of the A. R. E. A. to the World Engineering Congress which meets at Tokyo, Japan, from October 29 to November 7, will sail from Vancouver, B. C., on October 3. Other members of the A. R. E. A. who will attend the Congress are: Louis Yager, president of the association, J. M. R. Fairbairn, Ralph Modjeski, George M. Davidson, E. A. Sperry, Francis Lee Stuart, F. A. Gaby, W. S. Murray, Dr. A. N. Talbot and Dr. W. K. Hatt. Except for Mr. Fritch, who is the official representative, all of the others mentioned hold credentials as alternate delegates from the A. R. E. A. and most of them also officially represent other interests.

The report of the special Committee on Stresses in Track is now on the press and is expected to be issued in October. The 1929 edition of the Annual is now in the hands of the binder and will be ready for distribution early in October.

William C. Cushing, engineer of standards of the Pennsylvania, has been elected to honorary membership. This honor has previously been conferred upon only five other men and is given "in recognition of outstanding contributions to the science of railway engineering; for invaluable services rendered the association as committee member, committee chairman, director, vice-president, president and past president; and for acknowledged pre-eminence in railway engineering and management."

Bridge and Building Association

Every indication points to a large attendance at the thirty-ninth annual convention, which will be held at the Roosevelt hotel, New Orleans, La., on October 15-17. The program is as follows:

Tuesday, October 15

10:00 a. m. Convention called to order.
11:00 a. m. Address by President Maro Johnson.
Report of the secretary.
11:30 a. m. Report of the Commitee on the Selection and Training of Men for the Position of Foreman, C. J. Geyer, chairman, assistant to vice-president, Chesapeake & Ohio.
12:30 p. m. Adjournment.
2:00 p. m. Report of the Committee on Reducing the Cost of Maintaining Roadway Buildings and Small Stations, F. W. Hillman, chairman, assistant engineer maintenance, Chicago & North Western.
2:45 p. m. Paper on the Progress on the Suisun Bay Bridge by H. I. Benjamin, assistant bridge engineer, Southern Pacific.
3:30 p. m. Report of the Committee on the Relative Economy of Concrete Mixes, and Practical Tests for Concrete Aggregates, F. H. Cramer, chairman, assistant bridge engineer, Chicago, Burlington & Quincy.
4:30 p. m. Adjournment to visit exhibit of Bridge and Building Supply Men's Association.
7:30 p. m. Address on Southern Pine in Bridge and Building Work, by J. F. Carter, Southern Pine Association.
8:15 p. m. Address on Cypress in Bridge and Building Work (illustrated), by B. R. Ellis, Southern Cypress Manufacturer's Association.

Wednesday, October 16

9:30 a. m. Report by the Committee on the Maintenance of Water Transfer Facilities for Railway Equipment, C. W. Boyce, chairman, supervisor of bridges and buildings, Illinois Central.
10:30 a. m. Paper on the Fire on the Harahan Bridge at Memphis, by I. L. Simmons, bridge engineer, Chicago, Rock Island & Pacific.
11:30 a. m. Report of the Committee on the Elimination of Accidents to Bridge and Building Men Working off the Ground, W. R. Roof, chairman, bridge engineer, Chicago Great Western.
12:30 p. m. Report of Nominating committee.
Adjournment.
2:00 p. m. Report by the Committee on the Protection of Underground Pipe Lines from Deterioration, W. E. Pierce, chairman, supervisor of water service, Delaware & Hudson.
3:00 p. m. Report by the Committee on the Inspection and Maintenance of Track Scales, E. K. Lawrence, chairman, general scale inspector, Baltimore & Ohio.
4:00 p. m. Adjournment.

Thursday, October 17

9:00 a. m. Report by the Committee on Wearing Surfaces for Passenger and Freight Platforms, William Cardwell, chairman, supervisor of bridges and buildings, Washington Terminal.
10:00 a. m. Business session.

Bridge and Building Supply Association

In addition to the 30 firms, which were reported in the September issue as having arranged for space in the exhibit of the Bridge and Building Supply Men's Association at New Orleans, La., on October 15-17, in connection with the convention of the American Railway Bridge and Building Association, the following firms have also arranged for space:

The American Valve & Meter Co., Cincinnati, Ohio.
Argyle Railway Supply Company, Chicago.
The Barrett Company, New York.
Detroit Graphite Company, Detroit, Mich.
The DeVilbiss Company, Toledo, Ohio.
Joseph Dixon Crucible Company, Jersey City, N. J.
Federal Engineering Company, Chicago.
Hastings Signal anl Equipment Company, Boston, Mass.
The Insulite Company, Chicago.
Kaustine Company, Inc., Perry, N. Y.
The Patterson Sargent Company, Cleveland, Ohio.

RAILWAY NEWS BRIEFLY TOLD

During the month of June, the Missouri-Kansas-Texas treated 130,546,000 gal. of locomotive boiler water, removing 163,087 lb. of incrusting solids. After deducting all cost of treatment, supervision and interest and depreciation on the investment, the net saving was approximately $10,000.

The St. Louis-San Francisco has offered a reward of $5,000 for the arrest and conviction of the person or persons responsible for the wreck of a passenger train near Henryetta, Okla., on August 18, in which 11 passengers and two employees were killed as the result of a derailment at a switch which was found to have been tampered with.

In the last four and one-half years approximately 725 miles of new lines have been constructed in Western Texas and Oklahoma, with an additional 154 miles yet to be completed. In addition applications for the construction of more than 900 miles of new lines in this territory are now pending before the Interstate Commerce Commission.

During three days of the last week in August, more than 20,000 boys and girls returning home from New England summer camps, required the use of 400 extra cars by the Boston & Maine. The traffic department of this road estimates that these camps entertained a total of 50,000 youngsters from all parts of the United States and Canada during the summer.

Don't Burn up Your Job is the title of a 16-in. poster, printed in glaring colors, which has been prepared by the Railway Fire Protection Association to be used by the railways in the fire prevention campaign which is to be carried out during October. Copies can be secured at cost from R. H. Hackett, secretary, Baltimore & Ohio Building, Baltimore, Md.

Telegraph operators at 14 points on the Pennsylvania have completed courses in meteorology, to enable them to make daily weather forecasts for the use of Transcontinental Air Transport airplanes in the air-rail service of that road. Reports on the local weather conditions are sent three times daily to the meteorological service of the T. A. T. which, in turn, informs the airplane pilots of the weather conditions in advance of their positions.

The Interstate Commerce Commission has ordered an investigation of "reciprocity in the purchases by the railroads and the routing of traffic by manufacturers and dealers." The investigation is to be "with particular reference to the extent, if any, to which such purchases from any manufacturer, producer or dealer are dependent upon or influenced by the routing of traffic controlled directly or indirectly by such concerns."

The Soviet government has approved plans for the construction of 7,280 miles of new railway lines, to be completed within the next two years, and has already started work on 1,180 miles of these lines. The new line between the trans-Siberian railway and the Persian frontier is completed and will be ready for traffic in the next few weeks. The line running from Semipalatinsk is to be continued to the Afghan frontier. The remaining mileage will be in Siberia and the various lines planned, are to connect with existing lines as far north as Saroka and as far west as Moscow. The total cost of this two-year program is estimated to be $150,000,000.

An unusual tribute was paid to the late George Woods, formerly roadmaster on the Chicago, Rock Island & Pacific, by employees of the Panhandle division of that road, who dedicated a tree in the park at Geary, Okla., "in living memory" of Mr. Woods' long railway service. Near the tree a granite monument was also erected, to which is attached a bronze tablet bearing his name and service record. The monument was presented by employees, every department of the road being represented in the collection of the fund.

The Corps of Engineers, U. S. A., has organized a railway section, commanded by Capt. Marshall J. Jones, which will handle all railway work assigned to the Corps of Engineers. The duties of this section will also include the preparation of war plans for the construction, maintenance, and operation of railways in the war zone; the collection of data on the railways in this country and other countries for which war plans have been prepared; and contact with the railways.

The Third District Court of Appeals at Sacramento, Cal., has awarded damages of $16,175 to the plaintiff in a suit against the Southern Pacific on the grounds that when a railroad train, running behind schedule, wrecks an automobile at a crossing, killing or injuring the passengers, the company is guilty of contributory negligence. The suit was based on the charge that the train which demolished the plaintiff's automobile near Stockton was 25 min. late and that the plaintiff was familiar with the train schedules and would not have been injured except for the railroad's negligence.

While excellent progress has been made on the construction of the Hudson Bay Railway and the terminals at Fort Churchill, the new route will not be ready for full operation for two or three years, according to Col. A. E. Debuc, chief engineer, Department of Railways and Canals and D. W. McLachlan, engineer in charge of the St. Lawrence Waterways and Hudson Bay Terminals, who have recently returned from an inspection trip over the new line. Rail laying was completed last spring and ballasting is about completed, but second and third lifts will be necessary before this railway can be opened for traffic, and a large amount of other work yet remains to be done.

The Pennsylvania has awarded scholarships at the Stevens Institute of Technology for the ensuing school year to George W. Renninger, Northumberland, Pa., and John W. Sullivan, Arlington, N. J. These boys are the first to benefit by this scholarship, established last year, to be offered by the railway to sons of living and deceased Pennsylvania employees. Renninger is son of a yard conductor, while Sullivan is a son of a track foreman, deceased This scholarship is worth about $600 a year in addition to board and lodging. This road also announces that Herbert Lloyd Thomas, Jr., Harrisburg, Pa., and Thomas McCartin, Nazareth, Pa., are winners of the Frank Thomson memorial scholarships. These scholarships are worth about $800 annually and may be used at any technical college or university of good standing.

The rail cutters used by the winners in the Eastern region rail cutting contest, held by the Pennsylvania at Harrisburg, Pa., on June 11, have been presented to John Nelson, section foreman, Middle division and Domincio Ricci section foreman, Maryland division, who finished first and second respectively. This contest was similar to the one described on page 389 of the September issue. The cutters were nickel plated at the shops, and engraved with the names of the winners and the date and place of the contest.

Construction News

The Boston & Albany has awarded a contract to the J. F. Fitzgerald Construction Company, Boston, Mass., for the construction of a 25-stall engine house at Beacon Park yard, to cost $100,000.

The Canadian National has requested bids, through its subsidiary, the Montreal Stock Yards Company, for the construction of two buildings, a cattle and horse barn, 156 ft. by 344 ft., and a hog barn, 156 ft. by 401 ft. with a wing 78 ft. by 64 ft. Seven heavy duty stock scales will be installed.

This road also has made plans for the construction of a car shop 40 ft. by 180 ft. at Truro,, N. S.

This road has also begun the construction with company forces of the substructure for an 11-span deck plate girder bridge over the Canoe River, near Canoe River, B. C. It is expected that bids for the construction of the superstructure, which will replace a Howe truss span and timber trestle approaches, will be received early in 1930.

The Canadian Pacific has awarded a contract to the Hamilton Bridge Company, Hamilton, Ont., for the construction of a continuous type truss bridge over the Salmon river, near Keefers, B. C., to replace a steel arch at the same point. The new bridge will be constructed immediately adjacent to the existing structures but at an elevation 12 ft. higher than the latter. The contract for the substructure has been awarded to the Sidney E. Junkins Company, Vancouver, B. C., while the contract for the grading and construction of the aproaches has been let to the Chicago Construction Company, Vancouver.

The Centralia Terminal has applied to the Interstate Commerce Commission for authority to acquire one mile of line and construct 2½ miles additional in Lewis county, Washington.

The Chesapeake & Ohio has awarded a contract to the Graver Construction Corporation, East Chicago, Ind., for the construction of a settling tank 40 ft. in diameter and 40 ft. high, with a down take 12 ft. in diameter, at Boston, Ind.

This road has also awarded a contract to Boxley Bros., Inc., Orange, Va., for the construction of a fill to eliminate a bridge at Maysville, Ky., at an approximate cost of $221,000.

The Chicago & North Western has awarded a contract to the Graver Corporation, East Chicago, Ind., covering the construction of three water softening plants, to be located as follows: Clyman Junction, Wis., 20,000 gal. per hour with a storage capacity of 60,000 gal.; South Janesville, Wis., 15,000 gal. per hour, with storage for 35,000 gal.; Jefferson Junction, Wis., 12,500 gal. per hour, with storage for 50,000 gal. Another contract placed with this company covers an additional tank 21 ft. in diameter by 52 ft. high to enlarge the present water treating plant at Boone, Iowa, increasing its capacity from 23,000 gal. to 46,000 gal. per hour.

The Chicago, Milwaukee, St. Paul & Pacific has awarded contracts to the Howlett Construction Company, Moline, Ill., for the construction of six coaling stations to be located at Calmar, Iowa, Algona, Sanborn, Cedar Rapids, Ebner, Ill., and Terre Haute, Ind.

The Milwaukee has also awarded a contract to the Railroad Water & Coal Handling Company covering the construction of a pumping station at La-Crosse, Wis., which is to have a capacity of 15,000 gal. per hour.

The Chicago, Rock Island & Pacific has awarded contracts to the Railroad Water & Coal Handling Company for a water treating plant at Jefferson, Okla., with a capacity of 30,000 gal. per hour; a water treating plant at Whitewater, Kan., with a capacity of 20,000 gal. per hour; and the construction of oil storage facilities at Graver, Tex.

The Davenport, Rock Island & Northwestern has awarded a contract to the Howlett Construction Company, Moline, Ill., covering a 65-ton automatic coaling station to be built at Davenport, Iowa.

The Erie has awarded a contract to the Roberts & Schaefer Company to construct an "N. & W." type electric direct coaling plant, an "N. & W." type ash handling plant and a 500-ton sand drying and storage plant at its engine terminal at Dunmore, Pa.

The Grand Trunk Western has announced plans for the electrification of its main line between Detroit, Mich., and Pontiac, 26 miles, and the construction of a combined passenger station and an eight-story office building on Jefferson ave. between Dequindre and Orlean streets at Detroit. The plans for the electrification include electrified suburban service and the construction of an automobile speedway between Jefferson ave. and Pontiac, which will be supported on the columns carrying the overhead wires. The ultimate cost of the entire development will be $100,000,000, of which an immediate expenditure of $25,000,000 is proposed. It is expected that construction of the first units of the project will be undertaken shortly after January 1, and that the entire development will be completed in 1931. The proposed construction, however, is subject to the approval of the Michigan Public Utilities Commission.

This road has also let a contract to the Ogle Construction Company, Chicago, for the construction of a 300 ton electrically-operated reinforced concrete coaling station and sand handling plant at Pontiac, Mich.

The Great Northern filed an amended application with the Interstate Commerce Commission, asking authority to construct and operate an extension in Montana from Richey to Winnett, 195 miles, to acquire trackage rights over a line of the Chicago, Milwaukee, St. Paul & Pacific between Winnett and Grass Range, 21 miles, and either to complete and operate its partly constructed line between Grass Range and Lewiston, 32½ miles or to operate over the line of the Milwaukee for 37½ miles.

The Illinois Central's plans for the construction of a passenger terminal at New Orleans, La., have been approved by the Louisiana Public Service Commission.

The Mississippi Southern has applied to the Interstate Commerce Commission for authority to abandon its main line from Lumberton, Miss., to Kiln, 49.7 miles.

The Missouri Pacific has awarded a contract to J. H. Reddick, Fort Smith, Ark., for the construction of interlocking towers at Van Buren, Ark., and Sallisaw, Okla., and stock pens, a hay barn and office building at Texarkana, Ark.

The Nashville, Chattanooga & St. Louis has awarded a contract to the Southern Ferro Concrete Company, Atlanta, Ga., for the construction of a passenger station at Atlanta, at a cost of $225,000. This contract covers the erection of the building only. Other work in connection with this project, including the construction of platforms, platform sheds and tracks, will be handled by company forces at an estimated cost of $350,000.

The New York Central has awarded a contract to the Bates & Rogers Construction Company, New York, for the elimination of Harlem Avenue grade

New Line Mileage Again Feature of Month

The mileage of new lines contemplated is again the feature of the construction news of the month. As recorded in these columns, more than 950 miles of new lines, which will cost approximately $30,000,000, all of which are in the United States, were announced during the month. Another announcement of unusual interest is that of the decision of the Grand Trunk Western to electrify its line between Detroit, Mich., and Pontiac at an estimated cost of $100,000,000, of which $25,000,000 is to be expended immediately. Other features of interest are the large numbers of water and coaling stations for which contracts have been awarded. Other construction projects aggregating more than $2,000,000 include grade separations, line revisions, engine terminals, bridges, passenger stations, etc.

crossing in Cheektowaga, N. Y., at a cost of $165,600.

The New York, New Haven & Hartford has awarded a contract to C. W. Blakeslee & Sons, Inc., New Haven, Conn., for the revision of the alinement of its main tracks near Sachem's Head Station, Guilford, Conn. This work, which has been undertaken to reduce curvature, will cost about $160,000.

The Northern Pacific has awarded a contract to the Howlett Construction Company, Moline, Ill., for a complete set of machinery for a 100-ton coaling plant.

The Northern Pacific has filed an application with the Interstate Commerce Commission to build a line from Brockway, Mont., westerly to Jordan, 60 miles, thence southwesterly to Edwards an additional 27 miles. If built, this line will form an extension to the branch from Glendive, Mont., to Brockway, via Circle, which was completed in 1928. The estimated cost is $4,000,000.

The Pennsylvania has awarded contracts for construction work totaling approximately $743,000 as follows: To the Vare Construction Company, Philadelphia for the foundations for the catenary system in connection with its electrification between Philadelphia, Pa., and Norristown, $315,000; to the T. J. Foley Company, Pittsburgh, for the construction of an undergrade bridge at Haws crossing and an extension of the Stone Arch bridge over the Conemaugh river at Johnstown, Pa., $145,000; to the Vare Construction Company for the construction of a sub-station at West Philadelphia and a transmission line between this sub-station and North Philadelphia, $100,000; to the Di Nella Brothers' Company, Pittsburgh, for the elimination of a highway grade crossing at Canawaugus, N. Y., $65,000; to the F. H. McGraw Company, New York, for the relocation of break-bulk l. c. l. freight facilities in connection with its warehouse and freight terminal facilities at Jersey City, N. J., $50,000; to the James McGraw Company at Philadelphia for the construction of an overhead bridge to eliminate a grade crossing at Fishing Creek road at Rockville, Pa., $42,000 and to John J. Higgins, Waverly, N. Y., for the construction of a subway to eliminate a grade crossing in Canandaigua, N. Y., $26,000.

The Quanah, Acme & Pacific has applied to the Interstate Commerce Commission for authority to construct an extension from Matador, Tex., to North Peace river, 15 miles.

The Richmond, Fredericksburg & Potomac plans the rearrangement of tracks in its northbound classification yard at Potomac Yard, Va., in connection with the installation of a car retarder system. The total estimated cost of the project, including the necessary grading and the retarder equipment, is $548,500.

The Roswell & Corpus Christi Holding Company has been incorporated in Texas, with headquarters at Houston to construct a railroad between Roswell, N. Mex., and Corpus Christi, Tex., about 600 miles. Two routes are contemplated, one of which would cross the Texas & Pacific at Odessa, Tex., the Kansas City, Mexico & Orient at Sonora, and the Southern Pacific at Pearsall; the other would intersect the Texas & Pacific at Midland, Tex., and the Southern Pacific at Hondo.

The St. Louis-San Francisco has let a contract to the Kershaw Construction Company, Birmingham, Ala., for the construction of a passenger station at Aberdeen, Miss.

The South Plains & Santa Fe, which applied to the Interstate Commerce Commission for permission to construct an extension from Seagraves, Tex., to Lovington, N. Mex., 46 miles, and a branch line extending southerly for 43.5 miles, has submitted its evidence, and Examiner Haskell C. Davis has recommended in a proposed report to the commission, that the application for the extension be approved, but that it deny the application for the proposed branch.

The Texas & New Orleans and **Morgan's Louisiana & Texas Railroad & Steamship Company** have applied to the Interstate Commerce Commission for authority to extend their operations in Terrebonne Parish, La., by the construction of 7.3 miles of line, with the necessary connections to industries, from the present terminus of the M. L. & T. line to the margin of Bayou Grand Caillu.

The Texas & Pacific has awarded a contract to Gifford-Hill & Company, Dallas, Tex., for the grading for the site of a locomotive terminal at Big Spring, Tex. The work involves the excavation of about 150,000 cu. yd. It is planned to construct an enginehouse and other terminal buildings on the completed site.

The Texas-New Mexico, a subsidiary of the Texas & Pacific, which applied to the Interstate Commerce Commission for permission to build a line from the Texas-New Mexico state line to Lovington, N. Mex., 70 miles, has submitted its evidence and Examiner Haskell C. Davis has recommended, in a proposed report to the commission, that it issue a certificate of convenience and necessity for the construction of the line.

The Wyoming & Montana has approved the issuance of $15,000,000 in bonds for the purpose of constructing the Wyoming North & South between Craig, Colo., and Casper, Wyo., and between Miles City, Mont., and Salt Creek, Wyo. The proposed railroad will utilize the North & South Railway between Casper and Salt Creek, about 40 miles and connect with the Denver & Salt Lake at Craig, and with the Chicago, Milwaukee, St. Paul & Pacific and the Northern Pacific at Miles City.

Supply Trade News

General

The Crane Company, Chicago, will construct a one-story addition, 120 ft. by 220 ft., to its plant at Chicago at an estimated cost of $110,000.

The McWane Cast Iron Pipe Company has let a contract for a new office building in connection with its pipe plant at Birmingham, Ala.

The Harnischfeger Corporation, Milwaukee, Wis., has awarded a contract to Walter W. Oeflein, Inc., for the construction of a two-story addition to its administration building.

The Reliance Manufacturing Company, Massillon, Ohio, is planning an extension of its plant which will give an increased area of 10,500 sq. ft. of floor space and increase its heat-treating capacity about 25 per cent.

Personal

O. G. Newmann has become associated with the sales department of the **Inland Steel Company**, Chicago.

Ray P. McGrath, manager of the San Francisco office of the **Sullivan Machinery Company**, Chicago, since 1914, died on August 25.

H. O. K. Meister, general sales manager for the **Hyatt Roller Bearing Company**, Newark, N. J., has been appointed assistant general manager of the company.

M. D. Swift has been appointed district representative of the **American Fork & Hoe Company** for the Pacific Northwest, with headquarters at 912 Western ave., Seattle, Wash.

Gardner A. Murfey, who recently resigned as treasurer of the **Browning Company**, Cleveland, Ohio, on account of ill health, died suddenly on September 13, while returning from a vacation trip.

Perry W. Olliver has been appointed manager of the San Francisco office of the **Sullivan Machinery Company**, Chicago. He was formerly connected with the El Paso, Tex., office of this company. Mr. Olliver succeeds **Ray P. McGrath**, deceased.

George C. Stephenson, superintendent of the Port Reading plant of the Central of New Jersey and the Reading, with headquarters at Port Reading, N. J., resigned on September 1, to become connected with the **American Tar Products Company**, Pittsburgh, Pa.

Byron M. Cheney has resigned as district sales manager of the **Verona Tool Works** with headquarters at Chicago, to devote his time to personal interests. **Porter L. Laughlin**, formerly district sales manager for this company at Chicago has been re-appointed to this position to succeed Mr. Cheney.

Personal Mention

General

E. A. Booth, superintendent bridges, buildings and construction of the Beaver, Meade & Englewood, with headquarters at Forgan, Okla., has been promoted to superintendent, with headquarters at the same point.

The position of maintenance assistant to the general manager of the St. Louis-San Francisco was abolished on September 1, and **D. E. Gelwix,** who held the position, has been assigned to other duties.

C. S. Wiltsee, Jr., assistant superintendent of the Norfolk & Western timber treating plant at East Radford, Va., has been promoted to superintendent of this plant to succeed **C. W. B. Harris,** deceased. **W. E. Kemp,** treating supervisor, has been promoted to replace Mr. Wiltsee.

Ivan Thompson, chief clerk in the office of the division engineer at Jersey Shore, Pa., will have charge of the new centralized accounting bureau for the maintenance of way department which the New York Central has established at Utica, N. Y. The bureau which was opened September 16, will employ 80 clerks and will handle the accounts for all divisions on the lines east of Buffalo. The present forces in the offices of the division engineers will be modified to conform to the revised practices.

Everett E. Adams, assistant to the president of the Union Pacific System, in charge of purchases, engineering and standards, with headquarters at Omaha, Neb., has also been appointed vice-president. Mr. Adams was born on September 12, 1881, at Watertown, Mass. After graduating from the University of California, he entered railway service on August 1, 1905, as a mechanic on the Southern Pacific. He was later transferred to the engineering department, where he was promoted successively to assistant engineer and superintendent of the railway's pipe lines. From 1907 to 1913, he was employed as assistant engineer for the Union Pacific and assistant consulting engineer for the Southern Pacific at Chicago. Upon the dissolution of the two systems in 1913, he was appointed consulting engineer for the Union Pacific at New York. During Federal control of the railroads, Mr. Adams acted as assistant director of capital expenditures for the United States Railroad Administration at Washington, D. C. He returned to the Union Pacific as consulting engineer at New York on January 1, 1920. On March 1 of that year he was appointed assistant to the president in charge of purchases, engineering and standards, with headquarters at Omaha, Neb., which position he was holding at the time of his promotion to vice-president and assistant to the president on September 14.

Everett E. Adams

J. L. Haugh, assistant to the president of the Union Pacific System, with headquarters at Omaha, Neb., and an engineer by education and experience, has also been appointed vice-president. Mr. Haugh was born at Sodus, Mich., on October 17, 1887, and has been in railway service for 25 years. He spent two years at the University of Michigan and one year at the University of Wisconsin, entering railway service in 1904, as a rodman on the Cleveland, Chicago, Cincinnati & St. Louis. In 1905, he was employed as a draftsman on the Chicago & North Western and was then promoted successively to topographer, instrumentman, resident engineer and assistant engineer. From 1918 to 1920, Mr. Haugh served as engineering assistant to the regional director of the Northwestern region of the United States Railroad Administration, remaining in this position until March 1, 1920, when he was appointed assistant to the president of the Union Pacific, the position he was holding at the time of his appointment as vice-president and assistant to the president of the Union Pacific System on September 14.

Engineering

H. Horn has been appointed consulting engineer of the Chesapeake Beach, with headquarters at Washington, D. C. He will exercise direct supervision over track, bridges and buildings.

R. D. Copeland, assistant engineer maintenance of way of the Ann Arbor, with headquarters at Owosso, Mich., has been promoted to engineer maintenance of way, with headquarters at the same point.

R. B. Ball, chief engineer of the Coast Lines of the Atchison, Topeka & Santa Fe, with headquarters at Los Angeles, Cal., has been promoted to assistant chief engineer of the Santa Fe System, with headquarters at Chicago. **M. C. Blanchard,** chief engineer of the Western Lines of the Santa Fe and of the Panhandle & Santa Fe, with headquarters at Amarillo, Tex., has been transferred to the Coast Lines to succeed Mr. Ball. **W. W. Kelly,** district engineer of the Coast Lines, with headquarters at Los Angeles, has been promoted to chief engineer of the Western Lines and the Panhandle & Santa Fe, succeeding Mr. Blancard, **F. D. Kinnie,** division engineer, San Francisco Terminal district, has been promoted to district engineer to succeed Mr. Kelly.

Mr. Ball, has been connected with the engineering department of the Santa Fe for more than 26 years. He was born in Missouri and graduated from Leland Stanford University in 1904. Previous to that time, Mr. Ball had served for a year in the engineering department of the Coast Lines of the Sante Fe. In 1904, he re-entered Santa Fe service as an instrumentman, and advanced through various positions on the Coast Lines, including that of district engineer, with headquarters at Los Angeles, Cal., to which he was appointed in December, 1912. In July, 1918, he was promoted to chief enginer of the Coast Lines, with headquarters at Los Angeles. Mr. Ball's further promotion to assistant chief engineer of the Santa Fe system became effective on September 1.

R. B. Ball

A. B. B. Harris, system locating engineer on the Illinois Central, has been retired on a pension after 27 years service with that company. Mr. Harris was born July 15, 1859, in Goochland Co., Va. He was educated at the Virginia Military Institute and entered railway service with the Missouri Pacific in 1886 as an axman on construction. Three months later he was promoted to rodman and later to topographer and transitman. He left the service of this road in 1888 and was employed with a party which was making surveys for a new line in Georgia. In the latter part of this year he was engaged in surveys in the coal fields of West Virginia and in 1889 was employed as a civil engineer by the South Atlantic & Ohio, now a part of the Southern, and was promoted successively to engineer on maintenance, roadmaster and general superintendent and purchasing agent. After the merger of

this road with the Virginia & Southwestern he spent one year with the Seaboard Air Line as resident engineer and then went with the Atlantic Coast Lumber Company as superintendent of its railroad. Two years later, in 1902, he entered the service of the Illinois Central as division engineer at Memphis, and was successively assistant engineer on construction and division engineer until July 1, 1911 when he was promoted to locating engineer, the position he held at the time of his retirement July 15.

W. H. Moulthrop, whose promotion to assistant to the chief engineer of the Southern Pacific was noted in the May issue, entered the service of that road as confidential clerk to the late William Hood, at that time chief engineer. He was advanced successively to assistant chief clerk, chief clerk and office manager, which latter position he held at

W. H. Moulthrop

the time of Mr. Hood's retirement in 1921. He retained this position under George W. Boschke, Mr. Hood's successor, and in 1925 was given the additional duties of field manager. From 1922 to 1925 he was also assistant to Geo. W. Boschke, in his capacity as vice president in charge of the Albion Lumber Company. As office manager and field manager, for the Southern Pacific Mr. Moulthrop was actively connected with the construction of the Bayshore cut-off, the Natron cut-off, the double tracking of the line through the Sierra Nevada mountains, the San Diego & Arizona and the new line in Arizona, the Inter-California Railway and the line between Redwood City and Niles.

Albert F. Randolph, assistant to the division engineer of the Pennsylvania, Altoona, Pa., has been promoted to engineer in the offices of the chief engineer maintenance of way, with headquarters at Philadelphia, Pa. Mr. Randolph was born on July 24, 1882 at Bridgeton, N. J., and received his higher education at the University of Pennsylvania, from which he was graduated in 1903. He entered railway service on May 1, 1905, as a rodman on the New Jersey grand division, and in 1918 was promoted to chief draftsman on the Philadelphia division, with headquarters at Harrisburg, Pa. Two years later he was promoted to assistant to division engineer at Altoona, which position he was holding at the time of his recent promotion to engineer in the office of the chief engineer maintenance of way, at Philadelphia.

Track

M. A. Sheahan has been promoted to road supervisor of the Peoria district of the Illinois Central, with headquarters at Decatur, Ill., to succeed **John C. Crane,** retired on a pension after 37 years of service.

Thomas L. Williamson has been appointed roadmaster of the Modoc district of the Shasta division of the Southern Pacific, with headquarters at Alturas, Cal.

Nicholas Schiffley, assistant supervisor of track on the New York Central, with headquraters at Bryan, Ohio, has been retired after 45 years continuous service with that road.

Steve Kurzaba, whose promotion to roadmaster on the Canadian Pacific was noted in the September issue, was born on January 10, 1888, in Ukrainia. He received his education in that country and entered railway service with the Canadian Northern in May, 1906, as a section laborer. He was appointed section foreman on the Canadian Pacific in 1910, but in 1911, returned to the Canadian Northern in the same capacity where he remained until 1917. In that year he returned to the Canadian Pacific and in 1927, was promoted to relief roadmaster, which position he held until his recent promotion to roadmaster on July 1, 1929.

W. Bryant, roadmaster on the Edson division of the Canadian National, with headquarters at Coalspur, Alta., has been transferred to Edson, Alta., on the same division to succeed **T. A. Gallagher. W. Lucas,** section foreman at Rosevear, Alta., has been promoted to roadmaster, with headquarters at Coalspur, to succeed Mr. Bryant.

J. A. Olson has been appointed roadmaster on the Edmonton division of the Canadian National, with headquarters at Camrose, Alta., to succeed **J. A. McM. Brown,** whose accidental death was recorded in the September issue.

John Strachan, whose promotion to roadmaster on the Edmonton division of the Canadian National, with headquarters at Edmonton, Alta., was noted in the September issue, was born on March 31, 1886, at Halifax, Nova Scotia. His primary education was obtained in the schools at Acaciaville, N. S. Later, he attended St. Andrews College and Dalhousie University. He entered railway service on the National Trans-Continental as a rodman in 1905, being promoted successively to topographer, transitman and resident engineer. From 1915 to 1919, he was resident engineer on the Hudson Bay Railway. From 1919 to June, 1929, Mr. Strachan served as assistant engineer on the Canadian National, and was holding this position at the time of his promotion to roadmaster in June, 1929.

A. M. Spyres, roadmaster on the Kansas City Southern, with headquarters at Shreveport, La., has been granted a leave of absence because of ill health. **R. M. Murphy,** roadmaster, with headquarters at Leesville has been transferred to Shreveport to replace Mr. Spyres. **C. T. Bolton,** extra gang foreman at Shreveport, has been promoted to acting roadmaster to succeed Mr. Murphy.

O. M. Dawson formerly roadmaster on the Norfolk & Western, with headquarters at Buena Vista, Va., whose promotion to assistant superintendent on the Shenandoah division, with headquarters at Roanoke, Va., was noted in the August issue, was born June 3, 1897, at Bluefield, W. Va. He was educated at Emory and Henry College and at Roanoke College. He entered the service of the Norfolk & Western during the summer of 1911, working during the vacation. After completing his schooling he again entered the service of this road in 1916 as a chainman in the engineering department. He was later promoted to rodman and in 1923 was promoted to assistant roadmaster. He was promoted to roadmaster in 1927, which position he was holding at the time of his promotion to assistant superintendent on July 15.

John T. Stallings, whose promotion to roadmaster on the Mobile & Ohio, with headquarters at Murphysboro, Ill., was noted in the September issue, was born on August 31, 1876, in Noxubee county, Miss. He received a common school education and entered the service of the Mobile & Ohio in 1889, as a section laborer. He was section foreman and extra gang foreman from October 25, 1900, until August, 1920, when he was appointed wrecking foreman on the Mobile division. He was promoted to track supervisor on the Mobile district on February 11, 1922, and was holding this position at the time of his appointment to roadmaster on July 15, 1929.

Tony Zangar, whose promotion to roadmaster on the Northern Pacific was noted in the September issue, was born September 28, 1887, in Italy. He received his education in the public schools at Sprague, Wash., and entered railway service with the Northern Pacific on February 1, 1902, as a section laborer. On April 1, 1907, he was promoted to section foreman, and from that date until June 14, 1922, was section foreman and extra gang foreman. From the latter date until November, 1923, he was inspector on ballast and relay rail work. During 1924 and 1925, he was foreman in charge of a rail laying gang. In 1926, he was promoted to assistant roadmaster on the Idaho

division, which position he was holding at the time of his recent promotion to roadmaster.

Changes on the Pennsylvania

Spencer Danby, supervisor on the Monongahela division of the Pennsylvania, with headquarters at Conway, Pa., has been transferred to the Eastern region. **E. W. McGarvey,** supervisor on the Monongahela division, with headquarters at Uniontown, Pa., has been transferred to Conway to succeed Mr. Danby. **D. E. Rudisill,** assistant supervisor at Uniontown, has been promoted to supervisor, succeeding Mr. McGarvey. **R. H. Crew,** supervisor on the Pittsburgh division, with headquarters at East Liberty, Pa., has been transferred to the Eastern region and is succeeded by **L. B. Woods,** supervisor on the Pittsburgh division, with headquarters at Southside, Pittsburgh, Pa. **C. F. Montague,** assistant supervisor on the Eastern division, with headquarters at Canton, Ohio, has been promoted to supervisor, to succeed Mr. Woods. **C. R. Sanders,** assistant supervisor on the Conemaugh division, has been transferred to Canton to replace Mr. Montague, **R. D. Minsterl,** assistant on the engineering corps of the Panhandle division, has been promoted to assistant supervisor to replace Mr. Sanders.

A. P. Talbot, supervisor on the Pennsylvania at Hallidaysburg, Pa., has been transferred to Media, Pa., to succeed **J. B. Otto, Jr.,** who has been transferred to the temporary position of supervisor of track, special duty, on the Philadelphia Terminal division of the Pennsylvania. **H. O. Pritchard,** assistant supervisor at Ernest, Pa., has been promoted to supervisor with headquarters at Hallidaysburg, Pa., to succeed Mr. Talbot. **F. L. Brown,** astant supervisor at Chester, Pa., has been transferred to Ernest, Pa., to replace Mr. Pritchard.

G. A. Williams, whose promotion to supervisor of track with headquarters at Lock Haven, Pa., was noted in the September issue, was born on May 1, 1904, at Altoona, Pa., and graduated from Penn State University in 1927. He entered railway service with the Pennsylvania on June 9, 1927 as assistant on the engineering corps, with headquarters at Middletown, Pa., and on July 8 of that year was transferred to Tyrone, Pa. On February 18, 1928, he was promoted to assistant supervisor of track with headquarters at Phillipsburg, N. J., and later served in the same capacity at Camden, N. J., and Chester, Pa. He was located at Chester at the time of his recent promotion to supervisor of track.

T. J. Thomas, whose promotion to supervisor on the Pennsylvania was noted in the September issue, has been in railroad service since June 16, 1927. He was born at Wiconisco, Pa., on February 6, 1906, and received his higher education at Pennsylvania State College, from which he graduated in 1927. He entered railway service on June 16, 1927 with the Pennsylvania, as assistant on the engineering corps at Middletown, Pa. On June 1, 1928, he was promoted to assistant supervisor on subdivision No. 6, at Bordentown, N. J., and on November 1 of the same year he was transferred to subdivision No. 82 at Wilmington, Del. He was holding this position at the time of his recent promotion to supervisor at Cresson, Pa.

Carl McGhee, whose promotion to supervisor on the Pennsylvania was noted in the August issue, was born on March 12, 1894, at Kensington, Ohio. He received his education in the public schools at Kensington and entered the service of the Pennsylvania on April 1, 1912, as a section laborer. He was promoted to section foreman on March 12, 1917, and served as section and extra gang foreman until April, 1928. On the latter date he was promoted to general foreman on the Pittsburgh division and was again promoted on December 15, 1928, to assistant supervisor on the Buffalo division, with headquarters at Olean, N. Y. He was transferred to the Eastern division, with headquarters at Worcester, Ohio, on March 1, 1929, and was holding this position at the time of his promotion to supervisor on June 24, 1929.

Bridge and Building

W. R. Taggart, assistant master carpenter on the New York division of the Pennsylvania, has been promoted to master carpenter of the Buffalo division, with headquarters at Olean, N. Y., to succeed **R. E. Egloff.**

Isaiah Vosburgh, assistant supervisor of bridges and buildings on the Mohawk division of the New York Central, has been promoted to general bridge inspector on lines east of Buffalo, with headquarters at New York.

Purchasing and Stores

C. E. Smith, vice-president of the New York, New Haven & Hartford, has been given jurisdiction over the department of purchases and stores, succeeding **N. M. Rice,** deceased. Mr. Smith will retain his jurisdiction over engineering matters.

Ernest B. Rockwood has been appointed general storekeeper of the Boston & Albany, with headquarters at West Springfield, Mass. **George E. Johnson** has been appointed storekeeper and **Michael L. Sheehan** has been appointed material supervisor, with the same headquarters.

J. H. Brown, district storekeeper on the Canadian National, with headquarters at Toronto, Ont., has been promoted to assistant general storekeeper of the Atlantic region, with headquarters at Moncton, N. B. **Samuel Sneddon,** district storekeeper at Winnipeg, Man., has been transferred to Toronto to replace Mr. Brown. **Charles S. Argyle,** district storekeeper, with headquarters at Saskatoon, Sask., has been transferred to Edmonton, Alta., to succeed **Stewart E. Keillor,** who has been transferred to Winnipeg to replace Mr. Sneddon. **Charles B. Wright,** storekeeper at Point St. Charles, Montreal, Que., has been promoted to district storekeeper at Saskatoon to succeed Mr. Argyle. **J. B. Fraser,** storekeeper at Toronto, Ont., has been transferred to Point St. Charles to succeed Mr. Wright. **W. Huddleston,** storekeeper at Leaside, Toronto, replaces Mr. Fraser. **S. Woods,** storekeeper at Turcot, Montreal, succeeds Mr. Huddleston, at Leaside.

Obituary

James P. Nelson, special engineer of valuation of the Chesapeake & Ohio, with headquarters at Richmond, Va., died of an acute heart attack in that city on September 18.

Thomas J. Frazier, an engineer by training and experience, who retired from the real estate department of the Baltimore & Ohio about 14 years ago, died at Tiffin, Ohio, August 19.

John H. Hamer, supervisor of bridges and buildings on the Mohawk division of the New York Central, dropped dead in his office at Albany, N. Y., on August 10. Mr. Hamer was 61 years old and had been in the employ of the New York Central since 1890.

George K. McCormick, assistant engineer on the Cumberland Valley division of the Louisville & Nashville, died July 18. He was born at South Hampton, Pa., on October 8, 1858, and entered railway service with the Louisville & Nashville in August, 1889, as a resident engineer on construction. He was later appointed masonry inspector, and in 1903 was promoted to roadmaster, a position he held until recently, when he was appointed assistant engineer, the position he was holding at the time of his death on July 18.

Nathaniel M. Rice, vice-president in charge of purchases and stores of the New York, New Haven & Hartford, with headquarters at New Haven, Conn,. died in a hospital in that city on September 4. Mr. Rice was born on December 28, 1863, at Rome City, Ind., and was educated in public schools in that city. He entered the service of the Gulf, Colorado & Santa Fe as a brakeman in May, 1887, later serving in several positions in the transportation and stores department of that road and the Atchison, Topeka & Santa Fe until April, 1903, when he was promoted to general storekeeper of the latter road. On November 13, 1913, he was appointed general purchasing officer of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., later being promoted to second vice-president. Mr. Rice became general purchasing agent of the New York, New Haven & Hartford in 1920 and was promoted to vice-president in charge of purchases and stores in June, 1925.

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HASCO Hangers and Tell-tales will not tangle, corrode, rust or bend. They rarely require attention but when replacements are necessary they can be made from the ground by one man in a few moments' time.

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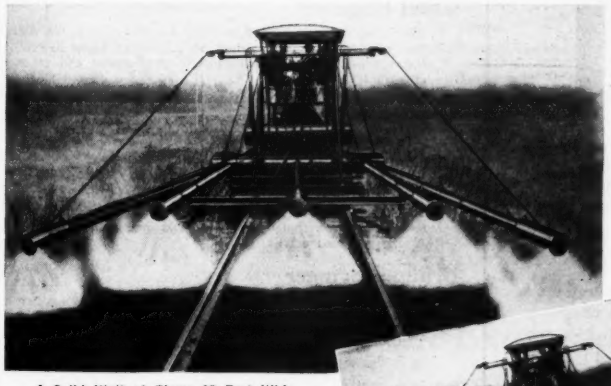

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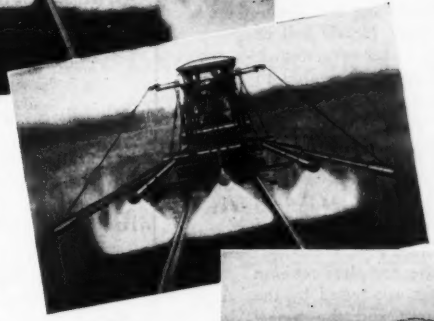
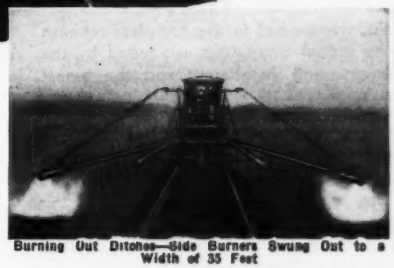


Burning on Ballast—Outside Burners Shut Off



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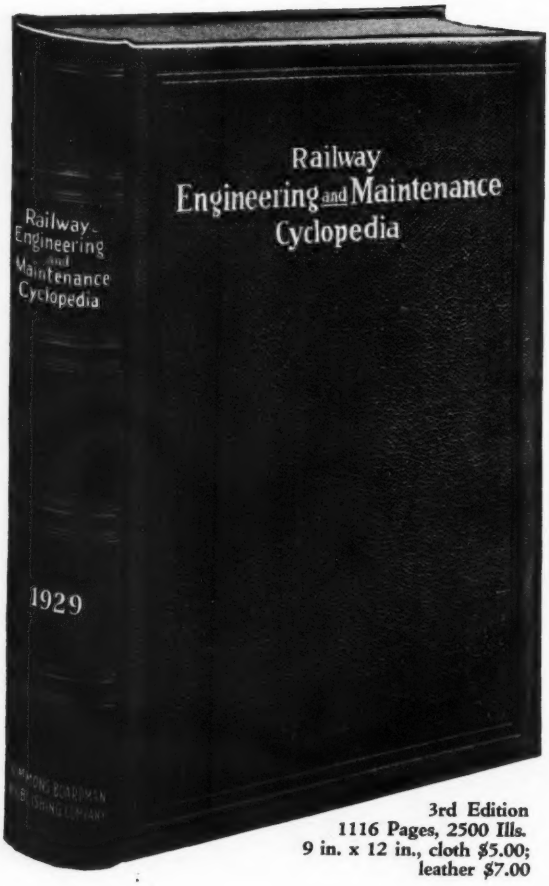

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The **Third Edition** of the **Railway Engineering and Maintenance Cyclopedia** was published July 22nd. Nearly half of the limited edition of 3,000 copies has been distributed. Owners of the new edition are recommending it highly to their friends who are sending for copies. At the present rate the 1929 edition will be out of print within a few months. To be on the safe side do not delay in placing your order.

The **Railway Engineering and Maintenance Cyclopedia** is the recognized authority on American railway engineering, maintenance and signaling practice. The eminent editorial staff listed on the right, was assisted in the complete revision of the 1926 edition by special committees appointed by the American Railway Engineering Association and the Signal Section of the A. R. A.

More than half of the text of the previous edition was rewritten and nearly 1,000 new illustrations were used to show the latest applications of materials and equipment. The information is complete, scientifically accurate and up to the minute. Full indexes make easily accessible information on any phase of a subject covered in the 100 chapters. Look over the Table of Contents on the next page.

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